Risk Management in Large Danish Public Capital Investment Programmes

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Department of Accounting and Auditing

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English abstract

This dissertation addresses one of the most popular management control practices adopted worldwide over the last three decades: the practice of risk management. The current risk management literature has argued that our knowledge of the particularities of risk management practices is limited. It has been stressed that knowledge is particularly lacking about the long-term effects of practising risk management. This dissertation responds to these calls by carrying out two longitudinal case studies of two large Danish public capital investment programmes, also known as mega-projects. The focus of the two studies has been on three key risk management-related aspects: (1) the translation of uncertainties into risks, (2) the relationship between frameworks and practices of risk management, and (3) the effects of practising risk management on knowledge and project management roles. The dissertation further advances current risk management literature into the study of mega-projects and draws upon actor-network theory. It consists of three papers, which each deals with one of the above aspects.

The dissertation presents three major findings. Firstly, it is demonstrated that, contrary to expectations, only some types of uncertainties are included as risks, termed pure risks, while others, termed impure risks, are systematically excluded despite the finding that people found them relevant to include. This finding is explained with reference to technical risk devices as these were found to define the boundaries between what can and what cannot be defined as an acceptable risk and thus be included. Secondly, the dissertation demonstrates that by enacting certain realities of 'risk' and 'risk management', frameworks of risk management make the practice produce the risks that confirm its propositions and thus its success. In addition, the dissertation shows that when provisional situations arise

which undermine the frameworks' propositions, reconfiguring the risk management control system, risk terminologies and the roles of actors become key actions performed to re-establish the practice. Lastly, the dissertation demonstrates that during project processes, new uncertainties emerge which challenge project and risk management objectives as new knowledge about the conditions is produced that cannot be included. In sum, this dissertation contributes by shedding light on how practices of risk management are constructed and the effects they produce over longer periods of time.

Danish abstract

Denne afhandling omhandler en af de mest populære økonomistyringspraksisser i moderne tid: risikostyring. I risikostyringslitteraturen er det blevet fremført, at vores viden om risikostyringspraksissers særlige karakteristika og dynamikker er begrænset. Forskere har yderligere understreget, at vores viden om de langsigtede effekter af risikostyring er begrænset. Denne afhandling imødekommer denne litteratur ved at beskrive to længerevarende casestudier af to større danske offentlige anlægsprojekter. Afhandlingen fokuserer særligt på tre risikostyringsrelaterede aspekter: (1) translationen af usikkerheder til risici, (2) forholdet mellem rammeværktøjer og risikostyringspraksis, og (3) virkningen af at praktisere risikostyring i forhold til viden og projektstyring. Afhandlingen bidrager endvidere ved at undersøge risikostyring i mega-projekter, hvilket tidligere studier kun har gjort i begrænset omfang. Afhandlingen trækker endvidere på aktør-netværksteorien og består af tre forskningspapirer, som hver især tager udgangspunkt i hver af de tre nævnte aspekter.

Afhandlingen bidrager på tre punkter. Den viser, at i modsætning til hvad man ville forvente er det kun visse typer usikkerheder, der indregnes som risici, såkaldte pure risks, mens andre typer, impure risks, ekskluderes fra processen, men lever videre i praksis. Afhandlingen forklarer dette med reference til de risikostyringsværktøjer, der anvendes hertil, da de sætter grænserne for, hvad der kan accepteres som risici, og hvad der ikke kan. For det andet viser afhandlingen, at risikostyringsrammeværktøjer ved at skabe visse forståelser af risici og risikostyring ender med at få praksis til at producere de risici, der bekræfter rammeværktøjernes postuleringer. Afhandlingen viser endvidere, at der kan opstå situationer, hvor der bliver tvivl om de resultater, som risikostyringen producerer. Dette er en usikker-

hed, som risikostyringen i sig selv producerer. I sådanne situationer kan risikoledelsen begynde med at undersøge de anvendte metoder og derefter igangsætte en mere eller mindre omfattende omdefinering af risikostyringskontrolsystemerne, risikoterminologier og nøglepersoners rolle for på den måde at genetablere praksis. Afhandlingen viser for det tredje, hvordan der på grund af risikostyringspraksis som sådan opstår nye usikkerheder, der udfordrer projektet og risikostyringens målsætninger. Sammenlagt bidrager denne afhandling med at sætte fokus på den måde man laver risikostyring på, samt de effekter dette genererer.

Acknowledgements

I would like to express my gratitude to Rail Net Denmark (Banedanmark) and especially Jesper Hansen, CEO, and the Signalling Programme Director, Morten Søndergaard, for allowing me into their organisation. Without their visionary outlook I would never have been able to undertake this project. I would also like to express my gratitude to the many employees, external consultants and stakeholders at large for letting me follow their intriguing work of risk management throughout the last five years. In particular I would like to thank Lars Frisk from Ramboll Denmark for his unrelenting efforts to invite me to risk meetings, facilitate new contacts, and for answering all the questions I had along the way. It was his, and their, open-mindedness that made the difference for this project.

It is moreover a long and tiresome journey to find one's way around academia. I have had the very good fortune to have two very competent and engaged supervisors to guide my way. I would like to thank Peter Skærbæk, my main supervisor, for his countless numbers of comments on my work. He always kept his door open to me when I was lost and guided me through the long and winding road that led me to this point. I would also like to thank Kjell Tryggestad, my co-supervisor, for his excellent comments on my ideas and research papers along the way, which helped me shape my project and continuously improve on my work.

In 2013, I spent seven months at the University of New South Wales' School of Accounting, Sydney, Australia. I would like to thank my supervisor during this stay, Christina Boedker, for our many discussions and her insightful comments. In particular, I would also like to thank Jane Baxter and Will Felps who allowed me to sit in on their PhD courses. I found great inspiration from these courses as they

broadened my perspective on current research that I had to take into consideration. I would also like to take this opportunity to thank the rest of the faculty at the School of Accounting, in particular Kar Ming Chong, who all welcomed me with open arms and made my stay an unforgettable and great experience.

To travel to the opposite side of the world and live there for seven months requires a lot of funds. I would therefore particularly like to thank COWIfonden and its board of directors for believing in this project from the beginning. Not only did they support my stay abroad with a significant amount of money, but they also invited me to present my research for a large group of practitioners on two occasions, which further helped me to develop my research and its relevance for those people actually practising risk management in "real" life.

Thanks are also due to the long list of scholars I met at various conferences, courses, and seminars throughout the last three years who provided up-front and honest comments on my project and allowed me to further develop my arguments. If research is really about participating in an on-going academic discussion, then where would I be if I had not engaged with these people? I would therefore like to thank all of those people I met along the way.

Lastly, I want to thank my dear friends and family who spent their time with me so I would not forget that there is more to life than writing a PhD dissertation. Thank you especially to Christa Kelberg, my partner, who took care of me and our infant son, Nor, especially during those long nights where he would not sleep.

Thank you
Tim Neerup Themsen

Abbreviations

English word	Danish word	Abbreviation
Booz Allen Hamilton	*(same)*	BAH
Copenhagen Mass Transit System	S-banen	S-bane
Enterprise Risk Management	*(same)*	ERM
European Rail Traffic Management System	*(same)*	ERTMS
Ministry of Culture	Kulturministeriet	MoC
Ministry of Finance	Finansministeriet	MoF
Ministry of Transport	Transportministeriet	MoT
National Audit Office of Denmark	Rigsrevisionen	NAOD
Rail Net Denmark	Banedanmark	RND
Regional Lines	Fjernbanen	F-bane
Road Directorate	Vejdirektoratet	RD
Signalling Programme	Signalprogrammet	SP

Preface

If undertaking a PhD project should be motivated by academic discussions, then I have failed horribly. I have spent days reading up on such discussions like all 'good' students are supposed to. I have positioned my conference presentations and seminars to such discussions like all 'good' students are supposed to. I have referred to such discussions and engaged my writing with them like all 'good' students are supposed to. In the beginning, however, I was unfamiliar with such discussions so how could I have been motivated by them? I was motivated by something different. I was motivated by something "out there", something empirical, something I found interesting and at the same time confusing. I was motivated by the situation that everybody seemed to praise this new thing called 'risk management' in large public capital investment programmes, and its ability to provide increased certainty of meeting programme objectives, while people at the very same time seemed to know little about its effects. It was as if people had adopted this new form of management control, blindly pouring millions of euros into its construction, which of course struck me as interesting because it seemed not to make sense, as people, at least broadly speaking, tend to be economically rational. As a result, I could not help thinking that there had to be more to this phenomenon.

But how did I learn about the above development? In the words of one of the head project managers I spoke with: "Is there anything *less* sexy than dealing with risk management?" (O38, 2). In 2009 I was looking for a subject for my master thesis, and without going into too much detail I ended up looking into practices of risk management. It was at this point that I met the CEO of Rail Net Denmark, who told me they had just received government approval for undertaking a new large capital investment programme called the Signalling Programme. He explained that

the government had put up the requirement that in order to prevent cost overruns, all large public transportation capital investment programmes had to implement an all-embracing practice of risk management. He also explained that the government had implemented risk management without specifying how it should be implemented and operated on large capital investment programmes; and he also explained that the Signalling Programme was the first public programme to be subjected to this requirement and therefore was intended to serve as a pilot test programme and a role-model for other public organisations.

To begin with, I found this situation to be a bit strange, as I could not help wondering how anyone could force someone else to abide by a practice they themselves were unfamiliar with. I therefore decided to meet key actors of the programme and study the formal documents related to this new legislation and the programme. This was where I became aware that the government had been inspired by Professor Bent Flyvbjerg's work on 'reference class forecasting', which had been implemented on similar programmes elsewhere.[1] In collaboration with other academics, Flyvbjerg had shown that over the last 70 years, 9 out of 10 so-called mega-projects ended up incurring cost overruns of between approx. 20 and 45 per cent. Flyvbjerg had further recommended, among other things, the implementation of an all-embracing practice of risk management to improve project control. In studying this research, however, I discovered that these findings and recommendations had been based on psychological experiments as well as on comparison between budgeted and actual costs. This research had not examined actual project processes and the effects of the practising of risk management on

[1] 'Reference Class Forecasting' is a project forecasting / cost estimation method that seeks to counteract personal and organisational sources of optimism by completely ignoring the details of the project at hand (the conventional approach, an inside view) and instead sets the costs of the project by examining a class of similar projects' cost after completion (an outside view). See (Flyvbjerg, 2006, 2008; Lovallo & Kahneman, 2003).

such processes. To sum up, I was struck by the observation that the government had legislated about risk management without knowing much about its effects.

This was what caught my attention. I then spent the following approx. six months following how the Signalling Programme constructed the practice of risk management (main focus) and the effects it generated (secondary due to a limited time period). I learned that the practice involved many different types of actors who all wanted different things from risk management. The Danish Ministry of Transport, for example, sought to improve their monitoring capabilities, as they had been criticised by the National Audit Office of Denmark for not having adequately exhibited this in the past. The Danish Ministry of Finance, however, wanted to increase the probability that the programme was finalised within the prescribed time and costs in order to avoid another major cost scandal like the construction of the Danish Radio Building. Of course, these objectives did not necessarily contradict each other, but the project managers, for example, primarily wanted a reflection tool to improve their project management abilities, which meant that they more or less did not care whether risk values rose. The Ministry of Finance and the National Audit Office, however, found this problematic, because to them this illustrated that the objectives of the programme had become more uncertain.

In early 2011 I completed my master thesis. I always felt, however, that there had had to be more to risk management and its mechanisms than I had had time to uncover: I had "only" followed the programme for six months, and the programme was still running for another 10 years, so I always felt that something more was bound to happen. As the opportunity arose to apply for a PhD scholarship on risk management in mid-2011, the decision was thus straight-forward: I applied. The rest is basically history. I got the PhD scholarship and carried out another three

years of in-depth study, this time expanded to include the Hospital Programme, the construction of 16 large new Danish hospitals. I found and read up on academic literature, went abroad for seven months, took the required semester's worth of PhD courses, taught for a full semester, presented my research at seminars, workshops and conferences around the world, performed the many administrative duties (in my opinion far too many), wrote and rewrote my three research papers again and again, and then again, took a day or two off now and again (yes, that did happen), and ultimately wrote the "cape" surrounding this dissertation.

I will not here go further into detail about everything that happened during the three-year PhD period as the present dissertation, hopefully, captures the outcome of this in much more detail. My aim has been to explain what initially motivated me to do this PhD project and write this dissertation. In the beginning, I was not motivated by contemporary academic discussions, as I still had to engage in them. Instead, I was motivated by an actual empirical development that made me question whether there was not more to this phenomenon called 'risk management' than initially met the eye. Later on, I discovered how I could contribute to the academic discussions with that empirically-inspired knowledge. I hope this "detour" has not transformed me into a "bad" student, now that I have not done what "good" students are supposed to do, as described above. I hope the readers of this dissertation will find it interesting, perhaps even thought-provoking, and a tool to eventually allow us to better understand this concept called 'risk management' in large (public) capital investment programmes, the so-called mega-projects.

This PhD dissertation is structured as an article-based dissertation. It consists of three papers which have each been given a separate chapter. To unite the papers, I have written a common introduction, background, method, literature review and

theory section that is placed before the papers, as well as a discussion and conclusion section placed after the papers. The latter section synthesises the main findings from the three papers and describes the contributions of the PhD project. It also sets out directions for future research and describes the implications and limitations of this dissertation. I have further taken the reference lists out of the individual papers and created one common list of references at the end of this dissertation. I have done this to give the reader easier and more approachable access to an overview of the literature.

Two of the papers have been presented to different audiences at conferences and seminars throughout the last three years. They have been presented with slightly varying content and titles. The first paper is co-authored with my main supervisor Peter Skærbæk, Department of Accounting and Auditing, Copenhagen Business School, Denmark, and the third paper with my co-supervisor Kjell Tryggestad, Department of Organization, Copenhagen Business School, and Chris Harty, School of Construction Management and Engineering, University of Reading, United Kingdom. The second paper is authored by me alone. Below is an overview of publication progress, including conference and seminar presentations:

- The first paper entitled: "The role of inscription devices in translating uncertainties into pure and impure risks" has been presented, albeit under slightly different titles, at the: "7th International Conference on Accounting, Auditing & Management in Public Sector Reforms", Milan, Italy, 4-6 September 2012 (by myself); "Alternative Accounts 2013 Conference", Toronto, Canada, 27-28 April, 2013 (by my co-author); "22nd Nordic Academy of Management Conference", Reykjavik, Iceland, 21-23 August, 2013 (by my co-author); "AOS Workshop", Galway, Ireland, 22-24

September, 2013 (by myself); "The Danish Rail Conference, Copenhagen, Denmark, 14 May, 2014 (by myself); as well as at two different seminars at the University of New South Wales, Sydney, 26 April 2013 and the Australian National University, Canberra, Australia, 3 May 2013 (both by myself). The paper made it through the initial review round of *Accounting Organizations and Society* and is currently awaiting my and my co-author's considerations before being resubmitted. This (working) paper is referred to as Themsen and Skærbæk (2014).

- The second paper is entitled: "The performativity of enterprise risk management in large public transportation infrastructure projects". It has so far only been presented at my final PhD seminar. It has been targeted to an accounting journal in its writing style, and I plan to submit it to an upcoming management accounting conference. See below for a reflection on publication opportunities.

- The third paper entitled: "Risk management and uncertainty in large infrastructure projects: What roles for knowledge and project management?" has been presented at the "ARCOM Conference", Portsmouth, UK, 1-3 September 2014 (by my co-authors). It went through a blind peer-review process for the conference with two anonymous reviewers who accepted it without revisions. It was presented in an abbreviated version with a slightly different perspective and published as part of the conference proceedings (Harty et al., 2014). My co-authors and I are planning to submit it to *Organization Studies* after the oral PhD defence.

I am well aware that all three papers have a substantial length (about 40 pages each) and that it may thus be difficult to get them published without making them shorter, as many journals only accept papers that have a maximum number of words less than that of my papers. In future, I will therefore scrutinise the papers with the purpose of examining how they can be reduced without losing their rich and detailed empirical descriptions. I am also aware that there are overlaps between the papers, because at least the first two papers are based on the same case study, namely the Signalling Programme. This may cause difficulties when it comes to publication, despite the fact that they examine different aspects of risk management and draw upon different theoretical concepts, and I will have to take that into consideration before I attempt to publish especially the second paper, as the first paper is already in review.

Good luck with the reading
Tim Neerup Themsen

Table of contents

1. Introduction

This section introduces the subject of this PhD project, namely risk management in large public capital investment programmes, also known as mega-projects, and sets the scene for the remaining sections of the present dissertation. The section begins with an introduction to risk management and megaprojects, an overview of current risk management literature, and a description of the limitations of that literature. It then moves on to describe the purpose and overall research question of this project (the three papers have individual and more specific research questions), the theoretical perspective applied and the method relied upon, and it concludes by giving an outline of the structure of the remaining dissertation.

1.1. Risk management and mega-projects

> *"Risk management and risk 'talk' are all around us. The risk-based description of organisational life is conspicuous. Not only private sector companies, but hospitals, schools, universities and many other public organisations, including the very highest levels of central government, have all been invaded to varying degrees by ideas about risk and its management". (Power, 2004, p. 9)*

This PhD project addresses one of the most proliferated and standardised management control practices worldwide over the last three decades: the practice of risk management. This practice has moved up on the agenda of governments and companies alike to transform the very nature of what management means (Kaplan et al., 2009; Miller et al., 2008). We have all been "invaded to varying degrees by ideas about risk and its management", in the words of Power (2004), and this goes

as well for "private sector companies, but also for hospitals, schools, universities and many other public organizations". In these years we cannot perceive of organisational management without mentioning the terms 'risk' and 'risk management'; it has become synonymous with ideals of 'good governance' (Power, 2007). In this respect there is nothing new about the idea of performing risk management, this has been done for centuries, but today there is an almost religious belief in its abilities to ensure organisational objectives (Bernstein, 1993). Listed companies, for example, have to comply with stock exchanges' listing requirements, which include notions of risk management (Christiansen & Koldertsova, 2009), and public bodies generally have to cope with government white papers on the same subject (Power, 2007). We do indeed live in the 'risk society' (Beck, 1992b).

One of the latest developments of risk management has been governments' worldwide enforcement of comprehensive and holistic practices of risk management in large public capital investment programmes.[2] These programmes, known as mega-projects, refer to major infrastructure programmes with costs of more than US$ 1 billion or programmes that otherwise attract public attention or political interests (Flyvbjerg et al., 2003). Governments have begun enforcing this practice because mega-projects have often ended up incurring substantial cost overruns, thus tying up public funds that could have been spent elsewhere. Over the last 70 years, nine out of ten transport infrastructure projects, for example, throughout the world have had cost overruns of an average of 45 per cent for rail projects, 34 per cent for tunnels and bridges, 20 per cent for road projects, and 28 per cent for all other transport project types (Flyvbjerg et al., 2002). This also goes for other types of mega-project such as power plants, dams, oil and gas extraction

[2] See for example: HM Treasury (2003, 2004), Transportministeriet [The Danish Ministry of Transport] (2006, 2008), Swiss Association of Road and Transportation Experts and The American Planning Association, cf. Flyvbjerg (2009), and The Australian Road and State Traffic Authority, cf. Liu et al., 2010.

projects, information technology projects, aerospace projects and weapon systems, where "the data show that other types of major projects are at least as, if not more, prone to cost overruns" (Flyvbjerg et al., 2003, p. 18, referring to other studies).

1.2. Current risk management literature

In the academic literature, the proliferation of 'risk' and 'risk management' has not gone unnoticed, and several academics have inquired into its prevalence from perspectives ranging from the rationalist-cognitive to socio-cultural (Gephart et al., 2009; Lupton, 1999). The literature taking the rationalist-cognitive perspective emerges from fields such as engineering, statistics, actuarial science, psychology, epidemiology and economics. This literature tends to regard the notion of 'risk' as dangers or hazards defined as "the product of the probability and consequences (magnitude and severity) of an adverse event" (Bradbury, 1989, p. 382). It focuses broadly on issues such as how well risks are identified and calculated, how accurate applied models and calculation techniques are, how the assessment of risk effects can be optimised, and how inclusive predictive models assisting peoples' assessments are (e.g. McNamara & Bromiley, 1999; Slovic, 1987). "One question that tends *not* to be asked in this research is 'How are risks constructed as social facts?', for the nature of risk is taken for granted" (Lupton, 1999, p. 18). While most practitioners would acknowledge that rationalist risk assessment relies at least to a certain degree upon human judgment, which is not value-free, this perspective tends to treat risks as objective facts (Bradbury, 1989, p. 382).

The rationalist-cognitive perspective thus understands 'risks' as pre-existing in nature and in principle able to be identified and controlled through scientific measurement and calculation, and the knowledge produced through this. It constructs individuals as calculating and emotion-free actors and assumes that they share the

same responses and preferences of the actors in utilitarian philosophy (Lupton, 1999, p. 22). In this respect, cognitive scientists often use psychological models of human behaviour to identify the ways in which people respond cognitively and behaviourally to risk (See Gilovich et al., 2002; Slovic, 1987 for reviews of this approach). This literature regards risks "as the independent variable and people's response to it as dependent", as Mary Douglas (1985, p. 25) writes. It often focuses on measuring the relative influence of different cognitive factor such as 'mental strategies' or 'heuristics' used in making judgments about risk, and points to biases related to this (e.g. Kahneman et al., 1982; Tversky & Kahneman, 1974). In relation to mega-projects, this literature has also been concerned with improving the basis for making demand and cost forecasts and thus solving decades of cost overruns (Flyvbjerg, 2006, 2008; Lovallo & Kahneman, 2003).

In relation to practices of risk management, another strand of literature has taken a functionalist perspective. From this perspective, 'risk management' is a neutral system fulfilling certain organisational functions with systematic differences occurring due to varying contextual factors (Donaldson, 2003). This literature has been much concerned with identifying such contextual factors, or contingencies (e.g. Beasley et al., 2005; Collier & Woods, 2011; Paape & Speklé, 2012). The literature also includes studies of the relation between risk management and company performance, indicating a strong positive correlation (Gordon et al., 2009; Hoyt & Liebenberg, 2011); as well as on improving actual risk calculation techniques (e.g. Imbeah & Guikema, 2009; Liu et al., 2010). In line with the rationalist-cognitive perspective, the literature also assumes risks to be "the independent variable" and the response of humans as "the dependent variable" and sees the purpose of risk management as being about identifying, assessing and reducing the risks "out there". This approach generally assumes humans to be calculating and

rational actors and does not take into account the mediating effects of such factors as relationships, institutions and political settings. This means that those studies drawing on this perspective, and the rationalist-cognitive, risk losing sight of the effects generated by the socio-cultural contexts in which risks are understood.

The socio-cultural perspective on risk emphasises the very aspects that the rationalist-cognitive and functionalist perspectives tend to neglect: the social and cultural context in which risks are understood and negotiated (Gephart et al., 2009; Lupton, 1999). This perspective roughly covers social constructivist, structuralist, poststructuralist and constructivist approaches. The scholars taking the social constructivist perspective tend to understand risk as being always embedded in cultures (e.g. Douglas, 1985; Douglas & Wildavsky, 1983). This perspective still understands risks as being "out there", but maintains that how we perceive them is embedded in cultures and thus neither static nor objective or individualistic. Such studies have been concerned with explaining variances between practices across organisations which all things being equal should be identical, how risks are conceived of by local actors, and how risk management is made relevant to different actors (e.g. Arena et al., 2010; Mikes, 2009, 2011; Wahlström, 2009). Mary Douglas has argued that heuristics or mental models cannot merely be considered as "cognitive aids for the individual decision maker", but "should be regarded as shared conventions, expectations and cultural categories that are founded on clear social functions and responsibilities" (Douglas, 1985, pp. 80-81).

Still within this perspective, the literature has further examined the proliferation of risk management from an institutional perspective, pointing to the influence by the accountancy profession on the logics and promotion of the concept (Hayne & Free, 2014; Power, 2004, 2007). Power has shown that risk management has

emerged alongside corporate financial scandals that gave rise to corporate governance and internal control standards. These standards were developed by the accountancy profession, which led to an intensification of auditing and control processes as these standards, among other things, were upgraded to regulatory requirements. This led to increased legalisation and bureaucratisation of organisational management, because risk management created a new demand for evidence of action. Power has also shown how risk management became a pervasive logic of organising as organisations sought to legitimise themselves and their actions (Power et al., 2009). Other studies have also dealt with the linkage between risk management and auditing, from the new uncertainties this has brought about to its new audit possibilities (e.g. Knechel, 2007; Robson et al., 2007; Spira & Page, 2003). In summary, these studies have all dealt with the pervasive influence of institutions on human behaviour and understanding through rules, norms and frameworks.

The institutional perspective bears much resemblance to the structuralist perspective, as this perspective deals with the study of the underlying structures, hierarchies and categories that define practices and knowledge of risk and its management. Two of the most prominent scholars in this field are Ulrik Beck (e.g. 1992b, 1999) and Anthony Giddens (e.g. 1991). Beck has argued that modern (western) societies are turning into 'risk societies'. In such societies, the production of 'goods' such as employment and welfare are accompanied by the production of 'risks' as an outcome, or "by-product", of modernisation processes. According to Beck, the "risks of modernization" are "irreversible threats to the life of plants, animals, and human beings" (Beck, 1992b, p. 13). He often shows anger towards this ever-hazardous nature of contemporary life and presents an almost apocalyptic vision of how risks will destroy humans and other living creatures. He further sym-

pathises with the rationalist-cognitive perspective, because "hazards require natural-scientific categories and measuring instruments in order to be "perceivable" at all" (Beck, 1995, p. 162). He has later argued, however, that the rationalist-cognitive perspective fails to realise the ways in which risks are manufactured and made politically dependent and thus falls short of dealing with risks (Beck, 2009).

Beck has further argued that modern (western) societies are confronted with risks on an unprecedented scale and that the magnitude and global nature of risks are such that risks are becoming almost impossible to assess, reduce or avoid (Beck, 1990, 1992b). He argues that risks are the result of human (political) decisions and that people (organisations, institutions) are now fighting each other over the distribution of them. In this sense, Beck's work shares many similarities with that of Anthony Giddens. Giddens also saw 'risk' as emerging from the realisation that the claims of modernity for human progress had been shown not to be as utopian as it once was thought (Lupton, 1999, p. 72). Giddens argues that with modernity, people can no longer rely on local knowledge, tradition, habits, religious precepts etc. to base their decisions on, as these traditional structures have broken down. As people still have to make decisions, and because hazards and dangers have come to be seen as the outcome of their decisions, this led Giddens to conclude that humans today *believe* that risks are more dominant than ever, thus that we live in a 'risk culture', but this originates from increased reflexivity about these decisions, and not, as stated by Beck, from an actual increase of risks.

Those taking a post-structuralist perspective have been concerned with the ways in which the discourses, strategies, practices and institutions serve to bring 'risk' and 'risk management' into being, to construct it as a phenomenon. "In this view, risk is created through discourses, strategies and practices of institutions and takes the

form of a calculative rationality rather than a thing" (Gephart et al., 2009, p. 146). Michael Power has shown how 'fraud risk' must be understood in relation to the broader historicity of risk in which risk expands its reach as an organising practice category (Power, 2013). In doing so, Power challenges the common-sense idea that the present shape of fraud risk management is functionally necessary, required by fraud events (thus challenging the functional perspective). He suggests that 'fraud risk' and 'fraud risk management' have turned into a 'regime of truth', a mechanism for governing and disciplining managers, "which has emerged from an expanding risk discourse and which shapes what it is possible to say with credibility" (Power, 2013, p. 542). From this perspective, there is more to 'risk' and 'risk management' than dealing with dangers and threats: "To calculate a risk is to master time, to discipline the future" (Ewald, 1991, p. 207).

To conclude, some scholars have taken a constructivist perspective and focused on the enabling effects of risk management technologies (e.g. Jordan et al., 2013; Kalthoff, 2005), the usefulness of inaccurate risk management models (Millo & MacKenzie, 2009), the linkage between accounting and risk management (Miller & O'Leary, 2007), and some of the unexpected effects that practices of risk management can generate (Vinnari & Skærbæk, 2014). This literature has conceived of risks as pure constructs and examined the networks of associations between actors in which risks have been produced as objects. From this perspective, then, 'risks' do not just represent 'dangers' that are "out there"; 'risks' themselves are constructions that come into existence when constructed as such (Hilgartner, 1992). The literature based on this perspective has further focused on describing the networks of relations in which risk management has been carried out, which have been shown not to be limited to fixed organisational boundaries. This perspective has differentiated itself from the social constructivist perspective by al-

lowing the role and effects of non-human actors to be taken into account, thus also acknowledging that risks can be constructs made by other actors than humans.

1.3. Limitations of the current risk management literature

The current risk management literature has advanced and expanded our knowledge about 'risk' and 'risk management' from different perspectives ranging from the rationalist-cognitive to socio-cultural perspectives. The rationalist-cognitive perspective has called our attention to potential human cognitive biases when identifying and assessing risks; the functional perspective to the importance of various contextual factors for determining differences between risk management practices; the social constructivist perspective to the importance of understanding 'risk' and 'risk management' to be embedded within cultural systems; the institutional perspective to the strong influence of the accountancy profession and its logic of auditability; the structuralist perspective to the emergence of 'risk' as a key modern macro phenomenon that differs from pre-modern ones; the post-structuralist to the disciplining effects of risk management discourses; and the constructivist to the enabling effects of technologies and the importance of understanding the construction of risks as part of larger networks of associations that are not limited to human beings. However, despite its enlightening contributions this literature has not examined all aspects of 'risk' and 'risk management' and the current literature thus stands incomplete (e.g. Bhimani, 2009; Gephart et al., 2009; Miller et al., 2008; Van der Stede, 2011; Vinnari & Skærbæk, 2014).

One of the major areas about which we lack knowledge is the "the particularities of risk management characteristics in specific organizational settings" (Bhimani, 2009, p. 4). The current risk management literature has tended not to focus on the mechanisms of practices of risk management as they develop through dynamic

processes over time. More specifically, the literature has tended to disregard the examination of the way in which risks are constructed as specific 'risk objects' through networks of relations. A few studies have sought to examine this (e.g. Jordan et al., 2013; Kalthoff, 2005), but this literature has been very limited and has focused mainly on the role of technologies. In general, this follows from the current literature's reliance on the philosophies of science underpinning the above perspectives, where 'risks' and 'risk management' have not been regarded as pure constructions. Thus, this literature has not, for example, assigned a much active status to non-human actors such as technologies or devices and tools. It seems that our knowledge of the actual mechanisms of risk management is incomplete as "the potential of these theories to inform studies of risk and organization has not been fully developed or realized" (Gephart et al., 2009, p. 142).

Furthermore, the current literature has largely not dealt with notions of 'risk' and' risk management' in large capital investment programmes, or mega-projects, but stayed within the "classical" limitations of either financial or non-financial companies. This seems regrettable, as governments today to an increasing extent rely upon comprehensive and holistic practices of risk management in order to ensure the success of such projects. The only literature that deals with notions of 'risk' and 'risk management' on mega-projects has been written by scholars taking a rationalist perspective (See Flyvbjerg, 2006; Flyvbjerg, 2008; Lovallo & Kahneman, 2003). Lovallo and Kahneman (2003), for example, propose that organisations supplement traditional forecasting methods with what they term 'reference class forecasting'. This method replaces the focus of traditional forecasting methods on the company's own capabilities and expectations, with a simple statistical analysis of analogous efforts completed on other similar projects, which should lead to the production of more accurate forecasts and thus counteract "personal and organiza-

tional sources of optimism" (Lovallo & Kahneman, 2003, p. 61). Flyvbjerg later added that it was important to combine reference class forecasting with "good quantified risk assessment… during project implementation" (Flyvbjerg, 2006, p. 14). Flyvbjerg and the consultancy COWI further developed more specific procedures for the British Department for Transport (Flyvbjerg & COWI, 2004).

However, due to its focus on preventing human cognitive biases and curbing organisational sources of optimism, the rationalist-cognitive perspective has not focused on the empirical effects generated by practices of risk management. This perspective has drawn on methods such as psychological experiments and budget vs. total costs comparisons and has thus ignored the examining of risk management processes as they take place in actual settings. As a result, we know little about what happens during project processes, how risks are constructed and managed, how they influence project conditions, etc. Another result is that governments these years are imposing risk management as a management control practice on public agencies or state-owned enterprises although they only have little knowledge of its effects. If we further take it into account that millions of euros goes into this practice, this only adds to the relevance of inquiring into this situation. It thus seems extremely relevant that research is conducted into the practices of risk management in mega-projects, from a perspective that allows such effects to be examined. I will later argue that the constructivist perspective allows this (Section 1.5 and 3.3), but before that, I will describe the purpose of this project.

1.4. The purpose of the present PhD project

This PhD project examines the practices of risk management in mega-projects. I have chosen mega-projects because governments implement risk management practices in such projects these years with much faith in their effect, but with only

a little knowledge of it. As stated above, governments have introduced risk management to prevent cost overruns and ensure the success of mega-projects, and rely on risk management practices to produce that effect. It would therefore be interesting to examine the effects and the construction of risk management practices, both in order to examine whether such a curbing effect is actually produced, but also, more importantly, to advance our understanding of the mechanisms of risk management practices. As mentioned before, another reason for choosing this subject is the observation that the potential of academic literature on risk management to inform studies of risk and organisation has not been fully developed or realised, (e.g. Gephart et al., 2009). If we further take into account that identical, standardised practices of risk management are implemented worldwide, which the next main section shows, this increases the relevance of advancing of our knowledge even further. I am guided by the following *overall* research question:

> How are practices of risk management on mega-projects constructed, what effects are produced, and how can we understand them?

As I seek to provide detailed and rich descriptions of practices of risk management in mega-projects by following such projects over a prolonged period of time, I have narrowed my scope to following two, however primarily one, mega-projects in the Danish public sector. I recognise that this to a large degree prevents generalisation, but it should provide for interesting new context-specific knowledge to be learned about the mechanisms of risk management, which scholars are calling for. In light that standardisation of risk management takes place around the world, which Section 2 shows, this new knowledge should still be highly relevant outside the context of my two examined cases (see Section 9.4 for more on this).

In seeking to answer this research question, the analytical section of this dissertation, Sections 6, 7 and 8, consists of *three research papers* which each deals with a separate aspect of the subject. The first paper focuses on the processes of translating uncertainties into manageable risks, i.e. how risk objects are constructed in practice, and the effects of risk management control systems. The second paper focuses on the relationship between frameworks and practices of risk management, i.e. how frameworks drawn upon come to enact the practising of risk management. The third paper focuses on the relationship between risk management practices and project conditions, i.e. how risk management practices shape project conditions and the effects this has on knowledge and project management roles.

1.5. My theoretical perspective: actor-network theory

In the present PhD project I draw upon actor-network theory, which is a constructivist and relational perspective. In following the actor-network theory, I do not consider risk as a static, objective phenomenon, like the rationalist-cognitive and functionalist perspectives tend to, or as embedded in cultural contexts, like the socio-cultural perspective assumes, but as constructed and negotiated objects that serve as part of dynamic networks of interaction. In quoting François Ewald: "Nothing is a risk in itself; there is no risk in reality. But on the other hand, anything *can* be a risk; it all depends on how one analyses the danger, considers the events" (1991, p. 199). Furthermore, I take non-human actors such as devices and tools into account as "active" actors, on equal terms with humans. Having taken this overall perspective means that what I see as important is *the ways in which certain linkages are drawn and the trajectories they take over time*. This means that I understand practices of risk management as *assemblages*, or networks, of various different actors, both human and non-human, that interact and generate effects, which can then be traced, recorded and described.

In more detail, I draw particularly on the works of Michel Callon (e.g. Callon, 1986, 1998c, 2007, 2009), but also on the work of Bruno Latour (e.g. Callon & Latour, 1981; Latour, 1991, 1993, 1996, 1999a, 1999b, 2005; Latour & Woolgar, 1986) and John Law (e.g. Law, 1986, 2009; Law & Hassard, 1999; Law & Urry, 2004) as Latour and Law have both been active in unfolding the overall philosophy of science of actor-network theory. The following is a brief outline of the benefits of having chosen actor-network theory, and it should be compared with the above sections about the current literature on risk management and the limitations of current risk management literature (see also Section 3). Subsequently, I will give a more thorough introduction to the fundamental, theoretical stand of actor-network theory and its basic concepts, which I have been guided by in my three research papers (see Section 4).

I have chosen actor-network theory for different reasons. The first (non-hierarchical) reason is that actor-network theory allows me to go *across* organisational boundaries and follow the actual associations made by those involved. It allows me to understand practices of risk management as *network effects* of the different actors' *associating work,* doing what they determine should be risk and risk-management related. This approach seems very suitable to examine public mega-projects where often many different actors are involved, such as political parties, ministries, public agencies, consultancies and suppliers. All these actors can influence how practices of risk management end up being constructed and operated over time, and they should therefore be included and not confined to be seen as "contextual factors". If we limit our study of risk management practices to exclude crossing boundaries, such as organisational or formal/informal boundaries, we may miss out on important actions and events. In summary, one of the advantages

of using actor-network theory is thus its strong emphasis that all types of associations must be taken into account, at least a priori (e.g. Latour, 1987).

The second reason is that actor-network theory enables me to pay attention to the effects of risk management technologies or non-human actors in broader terms. In actor-network theory: "we account for the solid objective reality by mobilizing various entities" (Latour, 2005, p. 91), which "implies *no* special motivation of *human individual* actors, nor of humans in general" (Latour, 1996, p. 373). In this sense, non-human actors can be active mediators which "transform, translate, distort, and modify the meaning or the elements they are supposed to carry" (Latour, 2005, p. 39). Section 4 returns to what this means later. At this point I just want to stress that in general, actor-network theory adopts a view in which devices can be more than passive devices that transport meaning without transformation. This latter view, where non-human actors are understood as passive tools, has often been called upon by the above socio-cultural perspectives. In Kaplan et al.'s (2009): "Managing Risk in the New World", for example, Mikes, who examines risk management from a social constructivist perspective, states that: "Models are not decision makers: people are. So the real issue is the culture that you have around modelling" (Kaplan et al., 2009, p. 70). In this sense, the advantage of adopting actor-network theory is the standpoint that actors "*literally* can be *anything* provided it is granted to be the source of an action" (Latour, 1996, p. 373).

The third and last reason for my choice of actor-network theory is its strong emphasis that knowledge should be derived from examination of actual empirical associations between actors such as those to be expected from practices of risk management. As Latour (1996, p. 374) says about actor-network theory: "It does not say anything about the shape of entities and actions, but only what the recording

device should be that would allow entities to be described in all their details". This means that actor-network theory places the burden of theories on the *recording* of entities and not on the specific shape that is *recorded*. In this sense, actor-network theory represents just as much a method as a theory, which fits nicely with my agenda of examining practices of risk management in mega-projects. As Latour further writes (1996, p. 374): "ANT [actor-network theory] is *not* a theory of action, no more than cartography is a theory on the shape of coast lines and deep sea ridges; it just qualifies what the observer should suppose in order for the coast lines to be recorded in their fine fractal patterns". In its essence, actor-network theory is thus about *describing* the ways in which practices of risk management are constructed rather than about *explaining* any underlying deterministic structures, cultures, systems, power relations, etc. It represents a toolbox of concepts for examining the assemblage of associations and their complex dynamics.

1.6. My method: case studies

In accordance with actor-network theory, this project thus continues along the path of "telling interesting stories" through empirical case studies, which can be understood as in-depth and detailed descriptions of real-life situations (Law, 2009, p. 142). One of the advantages of using case studies is that I can go "behind the scenes" of written documents and follow the actual practices of carrying out risk management as they take place in real time. This allows me to collect material that has not been captured by written reports that are typically prepared after events have unfolded and do not capture on-going negotiations or even conflicts. I can examine the actions of the people involved and shed light on the controversies, disagreements etc. that often constitute human interaction. I can 'follow the actors' and "describe the generative path of any narration", as Latour (1996, p. 374) calls it, which includes following non-human actors such as control systems and the ef-

fects they generate, and, of course, humans. To sum up, this enables me to track the networks of associations between those involved, without being limited by pre-set boundaries, and look "beyond the enterprise" (Miller, 1991, p. 757).

Why did I choose mega-projects then? In 2009, the Danish parliament authorised a total renewal of the Danish rail signalling infrastructure which had aged up to the point that its technical lifetime had well overrun. This programme was named *the Signalling Programme,* which refers to the total renewal of all signalling equipment ranging from basic train detection and point machines over the overall traffic management system to on-board train systems. I examine this as my primary case. The programme has a budgeted cost of DKK 23.7 billion and has been scheduled to run from 2009 to 2020 for the Copenhagen mass transit system and to 2021 for the regional lines.[3] I have chosen this programme because it is the *first* Danish attempt at implementing all-embracing risk management in large public capital investment programmes (Transportministeriet, 2006, 2008). This means that the involved actors have been confronted with having to do something for the first time, which in turn, from a methodological point of view, means that associations between actors have not yet been stabilised, or black-boxed, and thus should be more prone to controversies (Callon & Latour, 1981; Latour, 2005, p. 31). Such controversies, because "actors *do something* and don't just sit there", then generate more traceable information, which, all things being equal, represents the best opportunity for providing a good actor-network theory account (Latour, 2005, p. 128).

I also examine the Danish DKK 41.4-billion Hospital Programme, which consists of a complete structural overhaul of the Danish public healthcare sector. In con-

[3] DKK 23.7 billion corresponds to approx. EUR 3.2 billion (~ 1 euro equals approx. 7.5 Danish kroner). Except for research papers one and two (Sections 6 and 7), I use DKK throughout the dissertation.

trast to the Signalling Programme, which represents one mega-project, the Hospital Programme consists of 16 hospital construction projects, also mega-projects, all of which have been organised as individual projects managed by the same number of individual project organisations. The Hospital Programme runs from approx. 2008 to 2020 depending on the individual hospital projects. It is important to stress that the Hospital Programme has been examined secondarily to the Signalling Programme and that only the third of the three research papers build on data collected from the Hospital Programme, and that only in combination with data collected from the Signalling Programme. Furthermore, I have personally "only" been engaged with this project by looking into formal and informal documents related to the project and attending seminars and workshops where key actors of the Hospital Programme have been present. My co-authors are the ones who have carried out interviews and conducted most of the observations. As a result, more space has been dedicated to the Signalling Programme in the present dissertation.

To describe my data collection techniques, I rely on the collection of documents, observation studies and semi-structured interviews. The first and most important of these techniques is the collection of documents (Callon, 1991). I have collected both internally produced documents, such as internal memos, risk reports and presentation material, and more formal publicly available documents, such as government legal documents, formal project descriptions and public available status reports. The second technique, observation studies, is equally important, as these studies allowed me to follow the discussions of the different people involved in risk management. I have both attended formal risk meetings and observed people having more casual chats about risks and risk management in the course of their workdays. The observation studies were carried out as non-participating studies, which meant that I did not interfere with the discussions that took place in the

meetings I attended. The third and last data collection technique I used was semi-structured interviews conducted face-to-face with different people involved in risk management. This includes project managers, external consultants, train operating companies, civil servants, suppliers, and more. The strategy has been to interview those actors who according to my network-tracing activity held key positions.

1.7. Remaining dissertation structure

This subsection outlines the structure of the remaining dissertation and describes the content of its different sections. As this dissertation is article-based, this section includes the abstracts of the three research papers.

Section 2: "The proliferation of risk management". This section situates the project by describing the worldwide proliferation and standardisation of risk management and the emergence of risk management in the Danish public sector, with special focus on mega-project developments. This section also describes the events that preceded the Signalling Programme's establishment and points to its wide entanglement with key public and private sector actors. This section has been included to stress the timeliness and relevance of my project and to stress the potentially wide significance of my findings across types of organisations.

Section 3: "Current risk management literature". This section describes the current academic literature on 'risk' and 'risk management' and classifies it into different 'risk paradigms' dependent on its theoretical assumptions. This has been done to structure this section and to provide an overview of the current literature's contributions and limitations. This dissertation primarily takes into account the literature originating from the field of management accounting, but supplements this with seminal work across various fields of science. It also takes into account lit-

erature on mega-projects from across fields of sciences. The section ends by describing four avenues of future research to advance our knowledge of 'risk' and 'risk management'; four avenues which this dissertation covers in the three papers.

Section 4: "Theoretical framework". This section introduces the theoretical framework applied in this dissertation, actor-network theory, by elaborating on its basic concepts and underlying philosophical assumptions. This section does not go into detail of the more specific concepts that I rely upon in the three research papers; these concepts are introduced in the papers. This section also provides an overview of the major studies in the accounting literature that take on an either pure actor-network theory perspective or combine it with other theoretical perspectives, as well as the contributions made by these studies.

Section 5: "Method". The actor-network theory has methodological implications. This section begins by describing these implications. The remaining section has been divided into separate subsections dealing with: (1) the method chosen: (two) case studies, (2) the "units of analysis", which refer to the "who, what, when and where" of the dissertation, (3) the techniques employed to collect my information and the considerations given to their application; (4) my reflections on my own role as an observer and what it means to study mega-projects, and (5) the limitations that follow from carrying out case studies (i.e. the challenges of "following the actors").

Section 6: "The role of risk management inscription devices in translating uncertainties into pure and impure risks". This section represents the first of three analytical sections, which consists of my first research paper. The following is the abstract of the paper:

The processes of translating uncertainties, the potentially infinite number of unknown, into a more limited amount of manageable risks have been defined as the cornerstone of risk management, but have not been the object of many longitudinal studies so far. This paper examines a practice of risk management pertaining to the carrying out of a large public capital investment programme and sheds light, in particular, on the role and effects of risk management inscription devices. Drawing on the concepts of purification, framing and overflowing as advanced by actor-network theory, the paper shows that inscription devices, among other things, end up purifying the boundaries between which uncertainties can be included and which excluded as risks. The paper theorises the included risks to be the pure risks and the excluded risks to be the impure risks of the practice and shows that impure risks impair subsequent risk reduction. In contrast to pure risks, impure risks threaten the stability of the practice and its success in reducing all material risks. The paper contributes to current risk management literature by demonstrating the both enabling and constraining effects of inscription devices.

Section 7: "The performativity of enterprise risk management in large public transportation infrastructure projects". This section represents the second of three analytical sections, which consists of my second research paper. The following is the abstract of the paper:

In light of the implementation of frameworks of enterprise risk management in large public infrastructure projects, this paper explores the relations between enterprise risk management and an in-depth examined practice of risk management. The paper demonstrates that by performing certain realities of 'risk' and 'risk management', enterprise risk management made the practice construct the risks that confirmed its propositions. It further shows that the practice had difficulty sustaining the propositions of enterprise risk management over longer periods of time because situations arose which undermined those propositions. In these situations, the paper shows that reconfiguring the risk management control system, redefining risk terminologies, and redistributing the identities of actors became key conditions for stabilising the propositions of enterprise risk management. The paper concludes by stressing the importance of understanding the dynamic interaction between material devices, language and identities of actors as conditions of long-term risk management success.

Section 8: "Risk management and uncertainty in large infrastructure projects: What roles for knowledge and project management?" This section represents the third of three analytical sections, consisting of my third research paper. The following is the abstract of the paper:

Risk management devices and practices are routine parts of delivering large infrastructure projects. Risk management places emphasis on quantifying risks and developing strategies to manage, control and mitigate them. This means that the contribution by the on-

going production of knowledge during project processes is limited; instead, knowledge is positioned as upfront input to planning and specification. However, infrastructure projects are often characterised by long durations, by involving many actors at different stages, and by a high degree of uncertainty, ambiguity and complexity. This presents a problem for both risk management approaches and project managers: How can uncertain future conditions and unexpected events be reconciled with rational approaches to risk management? How is the production of new knowledge during project processes incorporated into risk management practices? What effects do risk management practices have on the on-going project? To address these questions, we draw upon two comparative case studies of large Danish infrastructure projects, using Callon's (1998a) dual notion of framing and overflowing. The cases demonstrate the emerging uncertainties that challenge project and risk management objectives as new knowledge about the conditions are produced during project processes, and describe the activities of project actors to both perform risk management as required, but also manage emerging uncertainties and concerns. We conclude that dominant risk management approaches neglect the wider range of uncertainties that emerge during project processes and that overreliance on these approaches threaten the long-term value and effectiveness of the project.

Section 9: "Discussion and conclusion". This section summarises the main claims from the three above-mentioned analytical sections / the three research papers. This section also describes the contributions of the dissertation by linking the main

claims made in the three analytical sections / the three research papers to the overall research question. This section also describes the implications of the findings for practice and practitioners, the limitations of this dissertation and sets out directions for future academic research.

Section 10: "References". All references from the dissertation's sections, including those from the three research papers, have been consolidated in this section to give the reader easier access to an overview of the literature. This section has been divided into primary and secondary references, where primary references refer to the (field) documents collected, and secondary references to the academic literature.

Section 11: "Appendices". This section contains the appendices of this dissertation. All appendices (or references made to the same figures etc.) from the research papers has similarly been consolidated. This has been done to avoid duplications and, again, to give the reader easier access to, in this instance, appendices.

2. The proliferation of risk management

This section situates the project by describing both the worldwide proliferation of risk management and the emergence of risk management locally in the Danish public sector, with special focus on mega-project developments. The length of the three research papers did not allow a description of the wider entanglements, which is why this section elaborates on that. The section also defines risk management according to worldwide best-practice frameworks and sets out its basic conception, which bears many similarities to that of the rationalist-cognitive perspective. It goes on to show the winding trajectories of risk management as well as its close entanglement with key central government actors through time and space as it got implemented in the Danish public sector and in the Signalling Programme in particular. I have included this section to stress the timeliness and relevance of my project and to stress the potentially wide significance of my findings across sectors, industries and types of organisations. I have further included it to describe in further detail the developments that preceded the Signalling Programme's parliamentary approval, developments that show the many different interests that the involved key public actors had invested in this practice.

2.1. Worldwide risk management developments

To begin with proliferation, the emergence of risk management can be ascribed to the development of corporate governance and the regulative control regime it brought about, which, in turn, was brought about by a range of corporate financial scandals (Power, 2007). In the mid-1990s, several corporate financial scandals, like the collapse of Baring Bank, led to criticism of current management and accounting practices for not having prevented them. In response, several standards (guidelines, frameworks etc.) were produced around the world by committees ap-

pointed by stock exchanges and the accountancy profession. Two of the major reports were The Financial Aspects of Corporate Governance's "Cadbury Report" on corporate governance principles (The Financial Aspects of Corporate Governance, 1992) and the Committee of Sponsoring Organizations of the Treadway Commission's (COSO) "Internal Control – Integrated Framework Report" on internal control (COSO, 1992). In summary, these standards introduced formalised and holistic approaches for management to improve control of their organisations and their objectives. In the years that followed, more corporate financial scandals surfaced, such as Enron and WorldCom, which this time led to direct regulatory intervention. As an example, in 2002 the US government passed the Sarbanes-Oxley Act, which prescribed that companies now *had* to produce an "internal control report".

One of the major elements of corporate (and later on public) governance from the beginning was the introduction of first risk assessments, and later actual risk management practices (IFAC, 2006). In 1985, the largest US accountancy associations sponsored the Committee of Sponsoring Organizations of the Treadway Commission (COSO) in an attempt to improve management control practices. In 1992, COSO produced their world famous standard "Internal Control – Integrated Framework" (COSO, 1992), as mentioned above, the application of which was rapidly expanded across the globe (COSO, 2004a). This framework had been produced to "keep the company on course toward profitability goals and achievement of its missions, and to minimise surprises along the way" (COSO, 1992, p. 1). The framework defined five key components, one of which was risk assessment, and stressed that this was an important element in dealing with these "surprises along the way" (COSO, 1992, p. 29). In 2004, due to the corporate scandals occurring around the turn of the millennium, but also to more general societal developments,

COSO separated risk management into its own framework: “Enterprise Risk Management – Integrated Framework” (COSO, 2004a). This framework was about more than just a separation of risk management, however; the framework “incorporated the internal control framework within it”, thus downgrading corporate governance and internal control to expressions of risk management (COSO, 2004b, p. v; but see also Hayne & Free, 2014, for a detailed description of the institutional work that led to this, and Spira & Page, 2003, who term this “the reinvention of internal control”).

COSO’s enterprise risk management framework has gained status as one of the world’s best-practice risk management frameworks and crystallises the core conception of risk management across counties, sectors and types of organisations (Power, 2007, 2009). It has absorbed earlier concepts like operational risk management, insurance risk management, strategic risk management and financial risk management (Verbano & Venturini, 2011) and stands as the most well-known framework across the globe (COSO, 2001; Fraser et al., 2008). It further defines the same core conception of ‘risk’ and ‘risk management’ as do other best-practice national and international standards (See Raz & Hillson, 2005 for a comparative review). The Project Management Institute’s “A Guide to the Project Management Body of Knowledge” (PMI, 2004), for example, identifies risk management as one of the key drivers of project success, and The Institute of Risk Management, The National Forum for Risk Management in the Public Sector, and The Association of Insurance and Risk Managers’ “A Risk Management Standard” (IRM et al., 2002) do the same for all types of organisations. This also follows from frameworks on project management in more general terms, where risk management has become a crucial part of ‘good’ project management (Winch, 2010; Winch & Maytorena, 2011). COSO ERM defines enterprise risk management as follows:

> *"Enterprise risk management is a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives". (COSO, 2004, p. 2)*

The COSO ERM definition of risk management "captures key concepts fundamental to how companies and other organizations manage risk, providing a basis for application across organizations, industries, and sectors" (COSO, 2004, p. 2). This definition reflects broad fundamental ideas. It follows that risk management should be understood as: an ongoing and iterative process; affected by people at every level of an organisation; applied in a strategic setting; applied across the enterprise at every level and unit; designed to identify potential events that, if they occur, will affect the organisation, and to manage risks within its appetite; able to provide reasonable assurance to organisational management and board of directors; and geared to the achievement of objectives. The underlying premise is that every organisation exists to provide value for its stakeholders. COSO writes that "all entities face uncertainty" and that "the challenge for management is to determine how much uncertainty to accept as it strives to grow stakeholder value" (COSO, 2004, p. 1). This value can then be achieved by the inherent capabilities of risk management, which are: "aligning risk appetite and strategy; enhancing risk response decisions; reducing operational surprises and losses; identifying and managing multiple and cross-enterprise risks; proactively seizing opportunities; and improving the deployment of capital" (COSO, 2004, p. 1).

The COSO ERM and similar different frameworks are based on the same basic components that organisations are recommended to follow if they want to achieve the above ideals of value production, increased organisational control and comply with 'good governance' tendencies. In their essence, these frameworks can be described as, firstly, defining the objectives of the organisation and aligning them with the organisation's risk appetite. This includes setting the tone of the organisation, the emphasis on risk management, the objectives of the practice, the ethical values of the organisation and more. Secondly, internal and external events that affect the achievement of the organisational objectives must be identified, distinguishing between risks and opportunities. Thirdly, risks must be analysed and assessed in relation to their probabilities and consequences (or likelihood and impact) as a basis for how they should be managed later on. In this respect, organisations are recommended to both exhibit quantitative calculations and qualitative judgment and plot these assessments into risk maps in order to generate overviews of the continued risk situation. Fourthly, management has to select appropriate risk responses ranging from acceptance, avoidance, reduction, sharing etc., and carry these out in order to match the pre-set risk appetite. And lastly, risk monitoring and control should take place to provide feedback on current risk developments to the effect that new risks are identified, current risks reassessed and new actions taken to ensure that the risk value is kept below the risk appetite.

While COSO ERM and similar frameworks outline the benefits to be gained from implementing them, they also recognise that there are certain limitations connected to such implementation. It follows that despite the strong emphasis in the frameworks on calculation and rationalistic knowledge conditions, risk management depends on human judgment, which can be "faulty" (COSO, 2004, p. 5). In addition, decisions on how to identify, assess and respond to risks need to consider

the relative costs and benefits; breakdowns can occur because of simple errors or mistakes; controls can be circumvented by the collusion of two or more people; and management has the capability of overriding employee risk management decisions. It is those elements that "preclude a board and management from having *absolute* assurance as to the achievement of the entity's objectives [my emphasis]" (COSO, 2004, p. 5). COSO ERM proposes, however, on the last page of the executive summary, that if all the actors involved, from board of directors, to senior management, other personnel, regulators, professional organisations, educators, consultants, etc., embrace this concept and embody and utilise its core understandings, then "these benefits *will* be realized [my emphasis]" (COSO, 2004, p. 7).

In conclusion, COSO ERM and similar frameworks reflect an understanding of 'risks' as objective facts or truths, although they recognise that risks can be more than dangers or threats, and also opportunities. They also build on the logic that risks can be controlled through rationalistic planning and structured identification and assessment processes. They do acknowledge that humans may have cognitive biases and that processes are open for manipulation, but rather than recognising this as pre-conditions, they tend to attribute this to so-called "limitations" or what can be described as "deviations" from an otherwise rational approach. They further encourage the reliance on statistical methods to calculate 'risk levels' from which proper courses of action can be taken, depending on the pre-set 'risk appetite'. In this connection, Power has compared their basic conception to the logic of that of a thermostat: "…which adjusts to changes in environment subject to a pre-given target temperature" (2009, p. 849). In sum, COSO ERM and similar frameworks thus end up becoming deeply rationalistic and functionalistic, which further because of their worldwide popularity now shape different organisations' ap-

proach to dealing with 'risk' and 'risk management', including in public mega-projects, to which the following Subsection 2.2 is dedicated.

2.2. Emergence of risk management in the Danish public sector

In the mid-1990s, around the same time that international corporate financial scandals were unfolding and discourses of corporate governance and risk management emerged, the country of Denmark watched as similar Danish public sector corporate scandals unfolded. One of the largest and most controversial cases was the Combus financial scandal. In 1995, Combus, the bus division of the state-owned train operating company, DSB, was spun off into a separate state-owned company; see statute no. 232 of 04/04/1995 (Transportministeriet, 1995). Three years later after its establishment, however, Combus suffered financial problems as operating accounts showed a large deficit (Rigsrevisionen, 1999a). The National Audit Office looked into the matter and arrived at the conclusion that Combus had "demonstrated financial imprudence" and that the Ministry of Transport as the governing administration "should have been aware of the inadequate management accounting practice exhibited [my translations]" (Rigsrevisionen, 1999a: I, 12). The National Audit Office further concluded that Combus had taken unnecessary *risks* when bidding for bus lines by only including very slim profit margins. This ultimately "contributed to the poor financial performance of the company [my translation]" (Rigsrevisionen, 1999a: I, 20-22). In the end, Combus was sold to the British company Arriva for the symbolic amount of DKK 100 and just barely avoided bankruptcy.

In September 1998, the Danish Public Account Committee requested that the National Audit Office look into yet another public financial scandal (Rigsrevisionen 1999b). From 1995 to 1998, the Danish Road Directorate had reported cost over-

runs on several minor capital investment programmes, which was a matter of concern to the Danish Parliament. The Road Directorate has the direct responsibility of planning, designing, operating and maintaining all state-owned roads. In 1999, the National Audit Office published their report, which concluded that "12 out of 15 programmes had budget deviations of more than plus-minus ten per cent of total costs [my translation]", which amounted to more than DKK 1 billion (Rigsrevisionen 1999b, I, 9). The National Audit Office attributed 82 per cent of that amount to changed project conditions caused by other government bodies than the Road Directorate, which thus mitigated the severity of the situation for the Road Directorate. At the same time, however, the National Audit Office wrote that "the Road Directorate should have *anticipated the risk* of extra costs during budgeting [my translation and emphasis]" (Rigsrevisionen 1999b, I, 10). The National Audit Office further emphasised "that no risk assessment and uncertainty calculations had been made" and found it "vitally important that such measures were made in future [my translations]" to avoid cost overruns (Rigsrevisionen 1999b, I, 21).

The National Audit Office slowly began to define risk assessments as a precondition for proper management control and accounting. The above two scandals and the subsequent two reports were two of the first public investigations which explicitly stressed the importance of risk assessments in ensuring proper management control. In 1999, the Ministry of Transport intensified its monitoring of the Road Directorate as they agreed to implement systematic risk assessment in all capital investment programmes in the Road Directorate's jurisdiction (Vejdirektoratet, 2000, p. 37). In the second of the two 1999 reports, the National Audit Office commented that they found this measure significant for providing a "loyal, clear and transparent [my translation]" overview of budget conditions (Rigsrevisionen 1999b, VI, 175). In Denmark, the Ministry of Transport receives

on average approx. 80 per cent of all nation-wide capital appropriations, which means that the largest part by far of all capital investment programmes falls within their jurisdiction to manage (see Appendix 1). This means also that capital expenditure scandals emerging from agencies under the auspice of the Ministry of Transport have the potential largest negative effects on total public capital expenditure. The Ministry of Transport is responsible for the entire transport infrastructure, which ranges from state road and railway networks to harbour, airport and postal facilities. The road and railway agencies receive the largest part by far of all capital appropriations, which makes developments in this area the most important for the control of total public capital expenditure.

In the years between 2000 and 2005, this situation made things worse as Rail Net Denmark (Banedanmark), the agency that manages the railway infrastructure, also revealed management control problems like those of the Road Directorate (Rigsrevisionen, 2002, 2004, 2005). In the Traffic Agreement covering the period from 2000 to 2004, Rail Net Denmark had received DKK 530 million extra a year to catch up with past decades of maintenance and renewal backlogs (Finansministeriet, 1999). It followed that Rail Net Denmark had to obtain DKK 140 million of this amount a year from improved internal operational efficiency. In 2002, however, the National Audit Office reported that Rail Net Denmark had achieved the planned amount of railways improvement, but that this had been done without any systematic knowledge of what had needed improvement. This prompted the National Audit Office to report that for many of the restorations projects that had been undertaken, Rail Net Denmark "failed to comply with the most basic financial management procedures and routines [my translation]" (Rigsrevisionen 2002, III, 149). The National Audit Office also criticised the fact that although Rail Net Denmark had achieved their DKK 140-million efficiency improvement, the organ-

isation was unable to document whether these savings were caused by increased efficiency or by other factors (Rigsrevisionen 2002, IV, 262).

As a consequence of the above-mentioned scandals, during this period, the National Audit Office also criticised the Ministry of Transport for lacking oversight with *all* of its agencies and enterprises (Rigsrevisionen, 2004). In 2002, this led the Public Accounts Committee to ask the National Audit Office to undertake a full performance audit of the Ministry of Transport. In 2004, the National Audit Office reported that the Ministry Transport's monitoring efforts had been unsatisfactory, and the Audit Office pointed to severe management information problems (Rigsrevisionen, 2004, I, 57). They did approve of the fact that the Ministry of Transport had implemented a new management control system in 2003, but criticised that the system had only been partly implemented and was "far from relevant [my translation]" (Rigsrevisionen, 2004, I, 15). In 2005, this culminated as the Finance Committee received word about 'irregularities' concerning state appropriation acts from Rail Net Denmark. The National Audit Office looked into seven different cases and found that due to inadequate accounting information, certain dispositions had been made without appropriational approval. The National Office concluded that the Ministry of Transport's oversight with Rail Net Denmark had been highly criticisable and that Rail Net Denmark's management control was unsatisfactory (Rigsrevisionen 2005, I, 89-94). In 2005, the CEO of Rail Net Denmark stood down.[4]

It was not only in the jurisdiction of the Ministry of Transport that capital investment programmes turned out to incur cost overruns. In 1999, the Danish National

[4] See Justesen and Skærbæk (2010) for more details on the Ministry of Transport's response to the National Audit Office's critique between the years 1999 and 2004. They describe how the Ministry of Transport attempted to cope with the critique, among other measures by implementing a risk management system.

Broadcasting Corporation (Danish Radio) decided to gather the different parts of its organisation into one single building, which was to be constructed. The construction costs had been budgeted at DKK 3 billion with an uncertainty margin of plus 15 or minus 10 per cent, meaning that the total construction costs had been estimated to end up somewhere between DKK 2.7 to 3.5 billion. It was also stated that Danish Radio expected the new headquarters to be completed by the end of 2004. In September 1999, the Danish Parliament's Finance Committee approved the construction act and agreed to finance about DKK 2.3 billion of the total costs through a state-guaranteed loan (the remaining costs to be financed by sale of existing buildings). Danish Radio planned to supervise the project themselves and therefore sat up a construction committee and a construction management organisation. In late 1999, Danish Radio commenced the construction of what would later be known as the Danish Radio Building. The Danish Ministry of Culture had the oversight responsibility, as Danish Radio fell within their jurisdiction.

The Danish Radio Building project turned out to be one of the largest Danish construction scandals with total costs of approx. DKK 4.7 billion, which was DKK 1.7 billion, or 57 per cent, over budget. In addition, the project went bad from the very beginning. In 2001, the construction programme had been delayed and the construction management organisation found inadequate. In 2002, the budget for constructing the prestigious concert hall had been overrun due to increased labour expenses. In 2003, MT Højgaard, one of the main contractors reported that the tendering material for the concert hall contained material errors which it would require large costs and delays to fix. In 2004, Danish Radio reported increased costs of advisory fees. In 2005, Danish Radio further had to realise that the parliament was unwilling to finance cost overruns of more than approx. DKK 300 million, which led to unwanted operational savings and construction compromises. In

2005, MT Højgaard announced that they had to postpone the completion date to the beginning of 2008, which led to organisational turmoil, as Danish Radio had to leave their existing premises by 2006. In the aftermath, 521 employees had to be laid off or let go in other ways; approx. DKK 300 million had to be saved annually in future; and the Chairman of the Board, the Director General, the Chief Financial Officer and the head project manager all had to step down (KPMG & Grant Thornton, 2008).

The National Audit Office had been involved from the early stages of this scandal in its capacity of the government annual auditor of state-owned enterprise and agencies. In September 2006, the National Audit Office further launched a special investigation into the Danish Radio Building project (Rigsrevisionen, 2006). In November 2006, however, the Danish Parliament Administration received a request from the chairman of the Cultural Affairs Committee to examine whether the National Audit Office was legally competent to undertake such an investigation. In an article printed in the "Weekly Newsletter for Board of Directors" [Ugebrev for bestyrelser] it had been claimed that the National Audit Office would be auditing their own work on the matter and was thus incompetent. The article based this claim on the National Audit Office's audit protocol from 2005, which had stated: "The National Audit Office concludes that Danish Radio has had *adequate* focus on the risks that can extend the project or lead to extra costs, and on unforeseen costs for the rest of the project period [my translation and emphasis]" (Folketingets Administration, 2006). The Parliament Administration found this situation problematic, and the National Auditor responded the following day by cancelling all on-going investigations into Danish Radio as "there can be no doubt concerning the National Audit Office's qualification and credibility [my translation]" (Rigsrevisionen, 2006, p. 1).

In 2007, the Danish parliament decided to conduct an investigation into the Danish Radio Building project with the purpose of "assessing the main causes of the increase in costs of the building project" (Kulturministeriet [Ministry of Culture], 2007). As the National Audit Office had itself withdrawn from the investigation, the auditors KPMG and Grant Thornton were contracted by the Ministry of Culture to carry out this task. KPMG and Grant Thornton came to the conclusion that the budget deviations primarily could be attributed to "poor management supervision" and "the lack of an effective management control system" stressing here "the lack of an effective risk management system" (KPMG & Grant Thornton, 2008, p. 26-32). In more detail, the auditors argued that management had failed to take all material uncertainties into account and failed to properly assess the likelihood and impact of those uncertainties that had been taken into account. This meant that the necessary actions to prevent cost overruns had not been taken and that "incomplete risk assessments therefore indirectly had contributed to the increase in the cost of the Danish Radio Building" (KPMG & Grant Thornton, 2008, p. 263). In sum, the Danish Radio Building scandal led to strong pressure on all enterprises and agencies across the public sector to implement risk management.

In 2006, this pressure was made into legislation on large public transport capital investment programmes, as the Danish Ministry of Finance [Finansministeriet] had become concerned with the technique applied to estimate total project costs. At that time, the most widely used technique was the 'successive principle method', or just 'successive calculation', which builds on statistics to integrate cost estimation with uncertainty analysis (Lichtenstein, 2000). The Ministry of Finance, however, had over some time experienced that projects using that principle tended to incur cost overruns (Finansministeriet, 2010). The Ministry also knew that pro-

jects abroad (using similar techniques) suffered from the same tendency and that research had shown that this was due to strategic misrepresentation, meaning that successive calculation was open to political manipulation (e.g. Flyvbjerg et al., 2002). Consequently, the Ministry of Finance decided to collaborate with the Ministry of Transport on developing what was later to be called the "New Budgeting Method". On 24 October 2006, this method was introduced for projects under the auspices of the Ministry of Transport that had a separate appropriation in the Financial Act or were legislated by parliament (Transportministeriet, 2006).

The "New Budgeting Method" introduced several new aspects into budgeting on large transportation project. These included banning successive calculation and replacing it by the use of experience-based costs from prior projects (Transportministeriet, 2006). This meant that all future risk estimates had to be excluded from the calculations. In the recognition that cost overruns still might happen, however, and that funds would have to be available for such a contingency, an experience-based contingency reserve, or risk margin, of 30 per cent was added. In the guidelines accompanying the "New Budgeting Method", it was also stated that management control practices had to be supported by a much more systematic approach to risk management (Transportministeriet, 2008). This was implemented in order to ideally prevent the risk margin from being used and to ensure project objectives. It was further stressed that this practice had to be implemented and operated throughout the lifetime of the project, and rely on fixed operating and documentation procedures. It was also made compulsory to implement an IT-based risk management control system along with a long list of much more specific requirements. In this respect, the Ministry of Finance argued that practices of risk management were to be constructed on the basis of best-practice

frameworks referring to, among other aspects, the before-mentioned COSO-framework (Finansministeriet, 2007).

The reason why the "New Budgeting Method" was turned into law on 24 October 2006 was because two days later, on 26 October 2006, the Danish parliament decided to go ahead with one of the largest Danish mega-projects to date: the Signalling Programme. In the period between 2000 and 2005, due to limited appropriated funds, Rail Net Denmark had not been in a position neither to perform maintenance of the signalling systems, nor to remove renewal backlogs, and by 2006 this caused major delays, something which the parliament could not avoid acting upon if they wanted an operational train service. The Ministry of Finance wanted to improve the Signalling Programme's chances of success, which is why the "New Budgeting Method" was approved immediately before the programme's approval. The Signalling Programme ended up becoming the first Danish attempt at implementing the "New Budgeting Method", including holistic risk management, as a practice to prevent cost overruns. In 2010, four years after implementation of the method, the Ministry of Finance declared "New Budgeting Method" a success. Today, it serves as a best-practice illustration for the rest of the public sector on how to deal with 'risk' and 'risk management' (Finansministeriet, 2010).

The following subsection (Section 2.3) turns the attention to the Signalling Programme and describes in more detail how it came into being, i.e. the actions and events leading up to the point where the project was given a green light. It is one thing to decide that organisations need to implement "best-practice risk management" and another thing for organisations to articulate it, to translate "best practice" into "actual practice". In the following subsection, I therefore describe how the practice of risk management was constructed. After this subsection, I will give

a brief overview of the main actions and events that happened in that (Section 2.4). I end the main section after this, as the papers give a more detailed account of the action and events that took place after the programme had come into being.

2.3. The Signalling Programme

The Signalling Programme came into being with the parliamentary decision to look into the possibilities of a permanent solution to the above-mentioned deterioration of the Danish rail signalling infrastructure (Finansministeriet, 2005). In 2005 the conditions of the signalling infrastructure had decayed to the point where train operation became problematic due to massive delays (Banedanmark, 2009a). In that same year, the Danish parliament decided to grant DKK 20 million to Rail Net Denmark towards a systematic assessment of the severity of the conditions, and, if necessary, the establishment of different investment strategies for dealing with this (Finansministeriet, 2005). Booz Allen Hamilton, a consultancy company, was contracted to undertake this assessment. In 2006, they submitted their report showing that the Danish signalling systems had aged to the point where many of the present systems had overrun their technical service life (Booz Allen Hamilton, 2006a). The report, called the 'Signalling Analysis', pointed to four different investment strategies with total replacement costs amounting to between DKK 25.8 and 33.1 billion: three successive age-based replacement strategies and one total replacement-based strategy (Booz Allen Hamilton, 2006a, p. 117). Booz Allen Hamilton further calculated that about DKK 18 billion, or about 50-70 per cent of the total replacement costs, represented risk values, i.e. unforeseen costs and budgetary uncertainty in general (Booz Allen Hamilton, 2006a, p. 113).

More specifically, Booz Allen Hamilton demonstrated that the existing signalling systems generated approximately 39,000 delayed trains every year and accounted

for about half of all the delays that Rail Net Denmark as the owner was responsible for (Banedanmark, 2009a). In Denmark, the rail network covers about 2,100 kilometres of lines and 3,000 kilometres of tracks and serves about 560 train sets and engines from four major operators every day. The existing railway systems are equipped with traditional signalling equipment, i.e. colour light signalling, train detection by means of track circuits and points operated by electric point machines. It covers 6,837 signals, 2,864 point machines and 563 level crossing facilities, which are all controlled by 77 CTC systems, with 364 associated substations, 274 interlocking systems, 244 line block installations and 1,713 train detection facilities (Booz Allen Hamilton, 2006a, p. 29). The rail network can be divided into two areas; the main regional lines (f-banen), which cover all inter-city train traffic; and the Copenhagen mass transit system (s-banen). The regional lines are operated from three larger regional control centres and 11 smaller control centres, and the mass transit system is operated from one large control centre. The Signalling Analysis took into account the age, errors, state and maintenance requirements of all of the above and concluded that the total renewal strategy would be the economically and technically best way to renew the systems (Banedanmark, 2009a).

The concept of total renewal was described as replacement of all signalling equipment from basic train detection and point machines to the overall traffic management system as well as on-board train communication systems, regardless of age (Banedanmark, 2009a). The key elements described were that all regional network signalling equipment had to be replaced with ERTMS (European Railway Traffic Management System) level 2-based signalling technology and modern computer-based area interlocking and state-of-the-art central control systems (Banedanmark, 2009a). ERTMS is a mandatory common European standard for train control and train radio systems that has been implemented to advance in-

teroperability across European countries. Similarly, all signals on the Copenhagen mass transit system network had to be replaced by a suitable metro/urban railway signalling system, i.e. a CBTC (Communication Based Train Control) system prepared for driverless operation (Banedanmark, 2009a). The key elements also included developing new national operational rules by adopting existing and proven sets of rules in accordance with European standards. Overall, the purpose of the total renewal strategy was to "implement the newest proven signalling technology, based on standard industrial hardware components, redundant system configurations offering uniform system interfaces and high reliability" (Banedanmark, 2009a, p. 9). The total renewal strategy was thus very ambitious.

Booz Allen Hamilton reported this back to Banestyregruppen (a steering committee), which had been established with members from the Ministry of Transport, the Ministry of Finance, the Traffic Authority, Danish State Railways, and Rail Net Denmark (Booz Allen Hamilton, 2006c). In 2006, when Booz Allen Hamilton presented their findings, Banestyregruppen was shocked by the calculated risk value of DKK 18 billion (I4, 12). Before the findings in the 'Signalling Analysis' came to its attention, Banestyregruppen had calculated with a risk value of approx. DKK 1 billion (I4, 12). Booz Allen Hamilton had used the successive calculation principle to calculate the risk value, and they had used the 50 percent fractile, which meant that the project had a 50 percent probability of being even more expensive. When especially the Ministry of Finance and the Ministry of Transport heard this, they questioned whether less risky investment strategies could not be pursued (I4, 94). In response, Booz Allen Hamilton was therefore asked to come up with two investment variants on the total replacement strategy which could reduce the 'value at risk' (I4, 16, 94). Booz Allen Hamilton did so, and when the

original ‘Signalling Analysis’ was submitted, it included an extra report with an analysis of two investment variants’ (Booz Allen Hamilton, 2006b).

Booz Allen Hamilton was able to reduce the risk value from approx. DKK 18 to 10 billion by primarily postponing the deadline across the network from 2016 to 2020, which allowed for an extended roll-out period and thus reduced the risk of delays (Booz Allen Hamilton, 2006c, pp. 33-34). This time, the total replacement costs were estimated to be about DKK 21.3 billion. Rail Net Denmark presented this to Banestyregruppen, where the representatives of the two ministries this time were less sceptical (I4, 130). The Ministry of Finance and the Ministry of Transport were still concerned with the size and complexity of the programme, but as expressed by one of the members of Banestyregruppen, this project was a “rock solid business case” that had to be undertaken (I4, 132). He explained that the entire operation of the rail network depended on the signalling systems, and because they would basically soon no longer function, they had to be replaced, that is, as he said, if the government wanted public rail transportation to be available (I4, 107). In summary, there was no disagreement about whether the project had to be undertaken, but the key actors were concerned whether the project could be completed within time and cost and thus not turn out as yet another public scandal.

On 26 October 2006, the Danish parliament endorsed the “rock solid business case” and decided that Rail Net Denmark were to plan the coming years’ investments, within their current funding, based on the intention to implement a total replacement of the existing signalling systems (Finansministeriet, 2006). The parliament further allocated DKK 100 million towards a more detailed analysis of the different total replacement scenarios in which the completion date was set to be 2018 and 2020 respectively. The agreement meant that Rail Net Denmark had to

establish detailed time plans, cost estimations and risk profiles for different total replacement scenarios; they had to propose two scenarios for the regional line, adhering to the ERTMS recommendations, and two scenarios for the mass transit system (Finansministeriet, 2006). In addition, Rail Net Denmark had to develop more scenarios if during this work they found different, but better replacement scenarios in relation to Booz Allen Hamilton's findings. The focus here was on time, cost and risks, and the project scenarios had to be so detailed that they could be used as a basis for potential later contractual procurement and thus move the project forward into its next phase (Banedanmark, 2008a).

In the years between 2006 and 2008, Rail Net Denmark carried out this work through an established project organisation called the Signalling Programme, which later became the organisation responsible for managing the replacement programme (Banedanmark, 2008a). The Signalling Programme had its own account in the Financial Act and reported to Rail Net Denmark's board of directors and the above-mentioned Banestyregruppen. To begin with, this organisation consisted of three people and therefore lacked the competencies to carry out the assigned task (I4, 18). Consequently, the Signalling Programme contracted external consultants from Ramboll A/S (Denmark), Emch+Berger Group AG (Switzerland) and R+R Burger und Partner AG (Switzerland) as collaborators (Banedanmark, 2008a). These consultancies had formed an international conglomerate together with Parsons (UK), RMCon (Switzerland) and Ramboll Management (Denmark) as sub-consultants, and had won the bidding. At the same time, the Signalling Programme began to hire more people on its own and thus develop into a more competent project organisation. In late 2008, Rail Net Denmark presented its findings in two major reports, both named after the Signalling Programme organisation: 'The Signalling Programme Background Report' and 'The Signalling Pro-

gramme Decision Report' (Banedanmark, 2008a, 2008b). These reports covered the findings made in extensive technical reports, two major project specification reports and an external quality assurance report.

Rail Net Denmark divided the programme into two major subprojects: the regional lines network and the mass transit system (Banedanmark, 2008a). For the regional lines subproject, Rail Net Denmark established four different scenarios of varying duration and calculated the socio-economic impacts, total costs and risk profiles of each of them. The third scenario, scheduled from 2009 to 2021, was recommended because it had the best trade-off between the above factors (Banedanmark, 2008b, p. 11). The Signalling Programme expected this scenario to improve train punctuality by approx. four percentage points due to the elimination of around 80 per cent of all signalling errors (Banedanmark, 2008b, p. 9). Also, ERTMS was expected to lead to more efficient infrastructure operation, maintenance and traffic control, increased safety levels on smaller train lines without automatic train control systems, and improved passenger information. The Signalling Programme further expected cost savings of approx. DKK 6.7 billion during the 25-year lifetime of the ERTMS-based system once implemented. The total replacement costs for the regional lines were estimated to be approx. DKK 19.6 billion, and the risk value to be approx. DKK 2.8 billion. Combined, the Signalling Programme estimated savings of about 790,000 hours in passenger delays per year.

For the mass transit system subproject, Rail Net Denmark similarly established four different scenarios of varying duration and calculated the socio-economic impacts, total costs and risk profiles of each of them. In contrast to the regional lines network, this analysis showed that a total replacement in the period from 2009 to 2020 had the unparalleled best socio-economic impacts, total costs and risk profile

(Banedanmark, 2008b, p. 15). The Signalling Programme also expected improved train punctuality, but in this case at a level of 0.8 percentage points, as well as improved train capacity, increased safety levels and improved passenger information. The total replacement costs were estimated to be DKK 4.1 billion and the risk value to be DKK 0.6 billion. Combined with the DKK 2.8 billion risk value of the regional lines subproject, this was therefore much lower than the original combined risk value of DKK 10 billion estimated by Booz Allen Hamilton. Rail Net Denmark explained that this reduction had been realised through the clarification of many technical issues, the establishment of a separate project organisation and an extension of the future phases (Banedanmark, 2008a).

Between the preparation of the 'Signalling Analysis' and the 'Signalling Programme' reports, however, the Ministry of Finance had grown tired of the calculation techniques applied on mega-projects, the successive calculation mentioned above (Finansministeriet, 2010). The Ministry of Finance had learned from experience that projects using successive calculation tended to produce unreliable estimations of total project costs. Booz Allen Hamilton had applied successive calculation when they prepared the initial investment strategies, but as mentioned above, this calculation technique was banned for transport mega-projects with the parliament's approval of the "New Budgeting Method". Booz Allen Hamilton had estimated total costs of the two extra investment strategies to be DKK 21.3 billion (including risk values), but these costs now had to be reassessed in order to comply with the new method. In practice this meant that Rail Net Denmark had to compare this programme to a reference class of programmes, but as such programmes did not exist, and because Rail Net Denmark wanted suppliers to bid on functional requirements (and then leave them to design their own system within those functional requirements) and not a long list of components, large parts of the

budget were therefore still the result of estimation. In addition, Rail Net Denmark had to exclude all risk estimates from the budget and instead apply the 30 percent risk reserve on actual prices.

The 'Signalling Programme' report showed that by excluding risk values but still including the 30 percent risk reserve, total replacement costs could be reduced to DKK 19.6 billion for the regional lines subproject and DKK 4.1 billion for the mass transit system subproject (Banedanmark, 2008b, pp. 35-66). Combined, this amounted to DKK 23.7 billion, which was DKK 2.4 billion higher than Booz Allen Hamilton's initial cost estimations of DKK 21.3 billion for the two extra investment variants. As Rail Net Denmark, however, had had to exclude risk values when using the "New Budgeting Method", the actual total replacement costs amounted to DKK 23.7 billion minus 30 per cent, or DKK 18.2 billion. Compared to Booz Allen Hamilton's estimate, this was thus DKK 3.1 billion lower, even despite the fact that another approx. DKK 3 billion worth of components had been added since Booz Allen Hamilton's initial assessment (Banedanmark, 2008b, p. 67). This difference was important, as the "New Budgeting Method" introduced risk management in order to make sure that the risk reserve of 30 per cent would not be used, and thus that the programme could be completed within the reduced DKK 18.2-billion budget (Transportministeriet, 2008).

In their approach to managing risks during the period 2006 to 2008, Ramboll, as one of the main advisors, took up the task of developing this required holistic and comprehensive practice of risk management (Banedanmark, 2008c). Ramboll developed what they described as a "state-of-the-art risk management system" (Banedanmark, 2008c, p. 5). In more detail, Ramboll described that they had followed the PMBOK best-practice recommendations, which included: "deciding on

how to approach, plan, and execute the risk management activities, determining which risks might affect the programme and document their characteristics, prioritising risks for subsequent further analysis or action by assessing and combining the risks probability of occurrence and consequence of impact, numerically analysing the effects on overall programme objectives of identified risks, developing options and action to enhance opportunities and to reduce threats to programme objectives, tracking identified risks, monitoring residual risks, identifying new risks, execution risk response plans, and evaluating their effectiveness throughout the programme lifecycle" (Banedanmark, 2008c, p. 44). Overall, this system enabled a structured approach to the identification, assessment, reduction and monitoring of risks throughout the lifetime of the programme and thus extended the system beyond the project specification phase (Banedanmark, 2008c, p. 6).

In adhering to the requirements of the "New Budgeting Method" to support the risk management practice by an IT-based risk management control system, Ramboll further developed a risk register to keep track of the status of identified risks (Banedanmark, 2008c, p. 13). This system also made it possible to keep track of risk reducing measures, to generate status overviews of current risks, to keep track of responsibilities and actions, to present plans for risk reduction and to provide documentation (Banedanmark, 2008c, p. 46). In order to identify significant risks, Ramboll also implemented a standard 5x5 risk-rating matrix, or what would later be known as "the traffic light assessment matrix", showing consequence on the x-axis and probability on the y-axis (See Appendix 4). This matrix was categorised into high (red), moderate (yellow), and low (green). Ramboll also specified the five probability classes according to different numerical percentage intervals and the five consequence classes into cost, time, benefit, punctuality, and reputation intervals (See Appendix 5). The register further allowed for the calculation of the

amount of total costs at risk, the so-called 'value at risk' calculations, by summing up the cost assessments across all risks. Last of all, Ramboll also defined a risk reporting format which would include detailed descriptions of the current top-ranked risks, comments on overall development, plans for controls and the calculation 'value at risk' (the total budget at stake).

During this period, Ramboll managed to reduce the risks from the approx. DKK 10 billion that Booz Allen Hamilton had calculated for the two additional investment variants to the DKK 3.4 billion described in the 'Signalling Programme' reports. As mentioned above, this had largely been achieved through the clarification and elaboration of technical details, the establishment of a separate project organisation and an extension of the tendering and roll-out phases. Furthermore, Ramboll mentioned that the risk value had been reduced due to detailed interface agreements with major train operating companies and because it had been decided to allow suppliers to take part in functional requirement specification. The major remaining risks were: lack of qualified staff; failure in tendering to secure the best value-for-money bid; lack of proper management skills; being a public project; lack of competition between suppliers; contractual disagreements; incorrect or incomplete asset data; and lacks, uncertainties and faults in functional specification requirements (Banedanmark, 2008c, p. 5). In 2008, however, Ramboll handed over the report and the risk management system as they, like the remaining members of the consultant consortium, had only been hired up until this point.

On 29 January 2009, the Danish parliament decided to appropriate the DKK 23.7 billion that had been estimated by Rail Net Denmark to fund the total replacement of the Danish rail signalling infrastructure (Transportministeriet, 2009a). The Signalling Programme had thus come into existence and had received a 'green light'

to renew the signalling infrastructure on the Copenhagen mass transit system before 2020 and the regional lines before 2021. Rail Net Denmark had agreed to meet two central political milestones where acceptance had to be given before the programme could move forward: (1) before publishing the tendering documentation; and (2) before the signing of the final contracts. It also followed from the government approval that funds would be appropriated only to bring forward the programme to its next political milestone. Rail Net Denmark further agreed to report on the Signalling Programme's progress and status in its bi-annually status report to the Danish Ministry of Transport, in Rail Net Denmark's annual reports, and in relation to the bi-annual follow-up on the Traffic Agreement for 2007, plus in an extended status report around each of the two milestones, both of the latter also to be handed in to the Ministry of Transport (Banedanmark, 2008b, p. 18).

In 2009, Rail Net Denmark again decided to contract external consultants as advisers, both to compensate for missing competencies, but also in order to reinforce the organisation with international experts. Rail Net Denmark had another bidding round, and this time they employed Ramboll (Denmark), Atkins (Denmark), Emch+Berger (Switzerland), and Parsons Group International (UK), who had formed a new consultancy conglomerate, as advisers to the remaining project phases. This time the contract was for the remaining lifetime of the programme. The Signalling Programme employs about 120 people on average throughout the period from 2009 to 2020/21, of whom about 40 are full-time employees and 80 are external consultants, although more are needed during implementation (Banedanmark, 2008a). The main tasks of constructing and implementing the signalling systems are handled by major suppliers, which are to be contracted. In the remaining phases of the programme, the Signalling Programme is primarily responsible for preparing the tendering material, carrying out contract negotiations

and subsequently following up on whether the suppliers adhere to the contractual obligations. Besides this, the Signalling Programme is responsible for educating relevant people from the main organisation, Rail Net Denmark, to undertake the new tasks arising and for ensuring coordination between the old and the new signalling infrastructure.

The Signalling Programme has been established as its own division in Rail Net Denmark and divided into five major subprojects: F-banen (the conventional / regional lines network), S-banen (the mass transit system network), Operational Rules, Civil Works, and Related Projects. The conventional / regional network (f-banen) and the mass transit system (s-banen) projects relate to the implementation of the signalling equipment and are by far the two largest subprojects. Operational Rules handles the development of the new safety and regulation documents required for getting approval to change the signalling system, and it also supports the other subprojects on technical-legal issues. Civil Works manages the construction of the required physical infrastructure, including two new traffic control centres; and Related Projects manages all other subprojects of which the On-board and the GSM are the largest. On-board manages the replacement of all on-board equipment for mainline trains and thus supports the F-bane subproject. GSM manages the implementation of new radio and data communication. Besides these five major subprojects, the Signalling Programme also has a range of technical and programme support units such as Quality Assurance, Contracting, Financial Management – and Risk Management. See Appendix 2 for an organisational chart.

The Signalling Programme goes through different phases. This section has provided an overview of the project proposal and the project specification phases that preceded the parliamentary approval of the project. Appendix 3 gives an overview

of the remaining phases for the two main projects, the f-bane and the s-bane projects. It shows that from 2009/2009 to 2011/2010, the programme undergoes the procurement phase, during which the tendering material is produced; the design phase runs from 2012/2011 to 2014/2012 and covers the detailed designing of the actual components to be implemented; the test phase runs from 2015/2013 to 2017/2015, where the signalling equipment will be tested on specific low-traffic train lines, and the roll-out phase runs from 2018/2015 to 2021/2020, where the programme has to pass the test as all rail lines have to have their signalling systems replaced. The first and especially the second research paper (the first and second analytical sections; Section 6 and 7) provide more information about what took place during those later phases up until the year 2014.

2.4. Overview of early developments

The figure below summarises the main events that led to the establishment of the Signalling Programme and the first Danish holistic practice of risk management in mega-projects. It shows the initial problematisation, which happened from 1997 to 2006; the contracting of Booz Allen Hamilton and the preparation of the initial strategies, which happened during 2006; the establishment of the Signalling Programme as a separate project organisation and the detailing of project specifications, which happened from 2006 to 2008; as well as the government allocation of funds to bring the Signalling Programme forward and the beginning of the operation of the practice of risk management, which happened from 2009 and onwards. I started my observation of the organisation in late 2009 when the programme organisation was preparing to move forward into the procurement phase. As I describe the events that happened after this later on in this dissertation, I will not go more into detail with the Signalling Programme at this point.

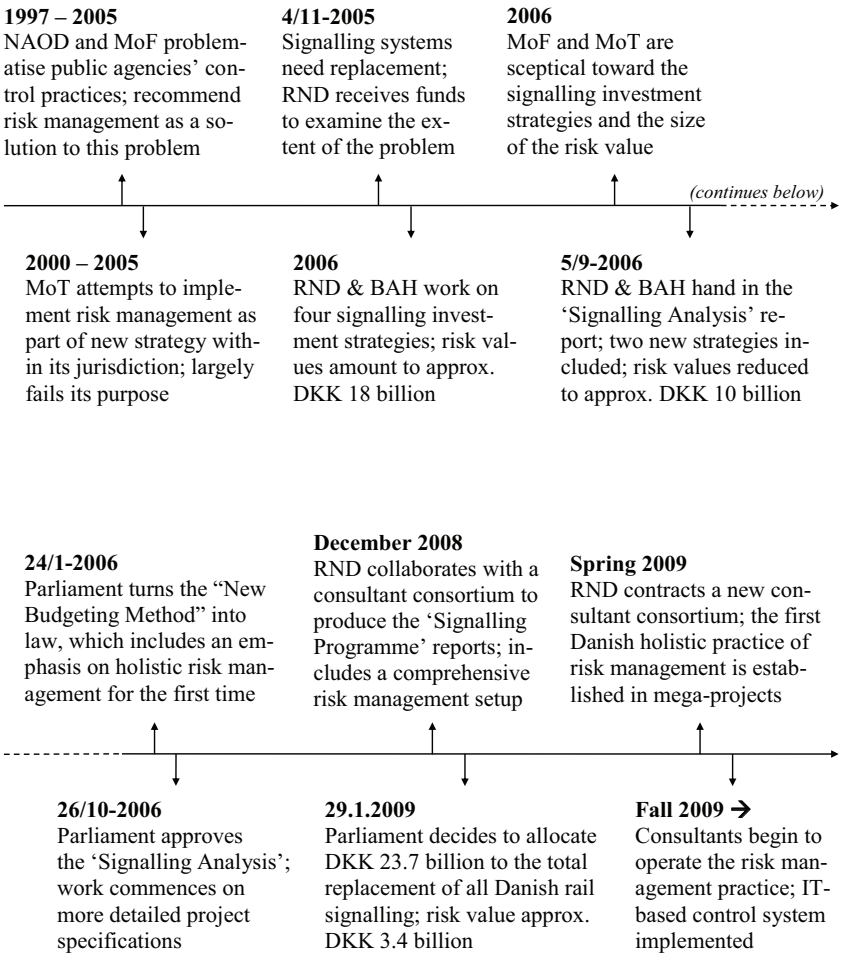

Figure 2.1: The main events leading up to the establishment of the Signalling Programme

3. Current risk management literature

This section describes the current academic literature on 'risk' and 'risk management'. I have classified this literature into different perspectives, or what I term risk paradigms, according to its theoretical assumptions. I have done this to structure the current literature and to provide an overview of its theoretical contributions and limitations. I want to stress that the literature on 'risk' and 'risk management' originates from several fields of science. In this dissertation I primarily focus on the literature originating from the field of management accounting. As I also focus on mega-projects, I include literature from other fields of science, such as project management, which deals with this. Lastly, I also take seminal work across various fields of science into account as these have typically contributed to our general understanding of the concepts of 'risk' and 'risk management'. The following, however, should not be taken as a complete review of all risk management literature from all fields of science. At the end of this section, I also explicate on some of the tensions/gaps in this literature and describe why studying them would be relevant, thus setting the scene for this dissertation's later contribution.

3.1. Classifying risk management literature

In this dissertation, I structure the current literature on risk management according to the notion of 'paradigms', which means that I focus on the general theoretical assumptions and laws that I consider as governing this literature. The term 'paradigm' was originally coined by Thomas Kuhn in 1962 in his treatise "The Structure of Scientific Revolutions", which came to be a landmark in the history, philosophy and sociology of science (Kuhn, 1962). The term refers to the "theoretical assumptions and laws and the techniques for their application that the members of a particular scientific community adopt" (Chalmers, 1999, p. 108). It also refers to

the application of common methods to a variety of situations, to the techniques and instruments necessary for bringing the laws of the paradigm to bear upon the world, and to recognised and accepted metaphysical and methodological principles (Chalmers, 1999, p. 112). In structuring the current risk management literature, and other types of literature, paradigms can thus be used to group studies that approach the nature of what should be studied, how to inquire into this, how to interpret the findings, etc., in the same way (Lukka, 2010).

In short, Kuhn termed the notion 'paradigm' to argue that science did not progress via linear accumulation of new objective knowledge, but underwent periodic revolutions, or what he called 'paradigm shifts', in which new modes of theoretical inquiring emerged. Kuhn argued that scientific disciplines tended to have periods of 'normal science' characterised by scientists adopting the same theoretical assumptions and laws, i.e. the same paradigm. Over time, however, more and more anomalies arose that could not be solved within the established paradigm, and when these began to threaten the very assumptions of the paradigm, the paradigm went into crisis. If such anomalies continued over time and resisted the attempts by the paradigm's members to remove them, this further led to scientific revolutions in which new and rival paradigms would emerge. If one of these new paradigms, in turn, attracted the allegiance of enough scientists, this could lead to the current paradigm being replaced by the new one. This new paradigm would then dominate new 'normal science' until yet again a new crisis emerged, which, in turn, would lead to new scientific revolutions, and so on.

In relation to risk management and the notion of 'normal science', academic scholars have argued that the risk management literature contains no common theoretical assumptions on which the literature has been based (Gephart et al., 2009;

Lupton, 1999). This literature has drawn on theoretical assumptions, methodologies, instruments, etc., from a variety of more established fields of science like sociology, psychology, statistics and economics. Kuhn's argument was that 'normal sciences', or what he called mature sciences, were characterised by being governed by one single paradigm. This distinguished it from more immature 'pre-sciences' in which disagreement about fundamentals ruled, and where many different theories, methods and techniques were applied to make sense of the phenomenon (Chalmers, 1999, p. 110). In the words of Kuhn, then, current risk management literature cannot be termed 'normal science' and should, at least for the moment, be termed 'pre-science' or an immature science, which, in turn, only seems to justify the need for explicating these key assumptions. In the following, I therefore: (1) classify the literature into paradigms in order to learn more about the fragmented field of risk management, and (2) use this classification as a stepping stone to point to unexplored aspects of risk management that future research, such as my own in this respect, could examine in more details.

In the following, I have classified the literature into paradigms that range from rationalist-cognitive to socio-cultural perspectives (See Gephart et al., 2009; Lupton, 1999 for similar classifications, however not applying the notion of paradigms). I acknowledge the argument that the literature could have been classified differently, like the classification of literature into 'positivist' and 'non-positivist' or alternative types of research (Baxter & Chua, 2003), into 'mainstream', 'interpretive' and 'critical' studies (Chua, 1986), or into 'consulting', 'basis', and 'critical' genres of research (Lukka & Granlund, 2002). I could also have categorised the literature more narrowly around specific types of assumptions rather than the broad notion of paradigms, like into 'assumptions about the nature of science' and 'assumptions about the nature of society' (Burrel & Morgan, 1979), or into differ-

ent 'scientific discourses' which could range from normative to interpretive, critical and dialogic (Deetz, 1996). I have chosen my approach because I found that it best reflected the literature I have read and because I found it well suited to position my actor-network theory approach and thus flesh out the relevance of this dissertation. To sum up, I decided on my approach not because I found it more right or wrong, but because I found it to make a difference for my research agenda.

More specifically, I have classified the current risk management literature according to its epistemological and ontological perspectives on 'risk' on 'risk management' from which elements such as methods, techniques and instruments typically follow. In doing this, I have focused on the theoretical stands expressed by the authors of the literature themselves. As many scholars in the field of risk management do not explicitly reflect on this aspect, however, I have also had to supplement this approach with different approaches. I have here looked at the key theoretical concepts employed, the general use of language, the references made to other researchers, and how the findings have been interpreted. These elements have been fruitful approaches to the classification of the current risk management literature. In some instances, however, I have come across works by researchers who have referred to key academic texts from incommensurable paradigms, which have made the classification more difficult. In these cases, I have classified the works as belonging to one paradigm. I recognise that this may not do justice to the researcher's intentions, and the following classification should therefore be taken as my interpretation of the current risk management literature.

3.1.1. Rationalist-cognitive risk paradigm

One of the main approaches to 'risk' and 'risk management' in both management accounting and project management literature as well as more generally in the lit-

erature can be classified as a rationalist-cognitive risk paradigm. It originates from fields of science such as actuarialism, statistics, engineering, epidemiology, economics and psychology (Gephart et al., 2009; Lupton, 1999; Power, 2007; Renn, 1992). The literature in this paradigm regards the notion of 'risk' as being "the product of the probability and consequences (magnitude and severity) of an adverse event" across the different fields (Bradbury, 1989, p. 382). This literature thus brings together notions of dangers, harm and hazards with the calculation of probability and seeks to anticipate "potential physical harm to human beings or ecosystems" (Renn, 1992, p. 59). In this perspective, the debate tends to revolve around how well risks have been identified or calculated, the level of seriousness of the effects of risks, how accurate is the science used to measure and calculate risks, and how inclusive are the causal and predictive models that have been constructed to understand why risks occur (Lupton, 1999, p. 18). It seldom focuses on practices or processes of 'risk management' (See Renn, 1992, 1998).

In addition, the rationalist-cognitive perspective understands 'risks' as pre-existing in nature, which in principle allows them to be identified and controlled through scientific measurement and calculation and the knowledge produced through such techniques (Lupton, 1999, p. 18). While most risk management practitioners would acknowledge that 'subjectiveness' is an evitable element of human judgment, and consequently not value-free, this perspective treats calculations as if they were objective facts, or truths, "out there" (Bradbury, 1989, p. 382). In actuarialism, for example, one of the great tenets that distinguishes it from bets or lotteries is that risks *are* calculable; they exist "out there" as objective facts to be modelled (Ewald, 1991). It must be possible to establish both a valid statistical table on the regularity of certain events and a calculus of the probabilities that these events will have an effect, and often also when and where. In broader terms, the

more rationalist literature in this paradigm, such as, again, actuarialism, but also statistics, engineering and epidemiology, all tend to focus on rationalist risk analysis methods. These methods have been developed to identify and avoid the causes of risks and/or to mitigate the unwanted consequences of the risks in order to improve the well-being of humans or society at large (Renn, 1992, p. 59), or the overall financial performance of firms (e.g. Alviniussen & Jankensgard, 2009). This means that this literature has focused on developing models, methods, etc., which "optimises" the relationship between the risks "out there" and the processes of identification and assessment "in here".

The literature on economics has focused on translating perceptions of physical dangers or other undesired effects into subjective utilities, with the base unit describing the degree of satisfaction or dissatisfaction associated with a possible action (Renn, 1992). This perspective thus similarly understands risks as being objective facts, but focuses more on the subjective (dis)satisfaction with the potential consequences of the dangers. In economics, this serves two major purposes: (1) subjective (dis)satisfaction can be measured for all consequences, including psychological or social effects; and (2) subjective (dis)satisfaction allows a direct comparison between risk and benefits across different options (Renn, 1992). If risks can be expressed like this in terms of utilities, this allows their integration into decision processes in which costs and benefits can be assessed, compared and prioritised. As risks denote possible costs and not actual costs, they also have to be weighted by their probability of occurrence and discounted, hence the often used probability x consequence calculation. Economic theory here regards risk analysis as part of a larger cost-benefit consideration in which risks are the expected utility losses resulting from an event or an activity (Renn, 1992). The goal of economics in this respect is to allocate resources in order to maximise their utility for society.

In contrast, but still within the same risk paradigm, the psychological literature has studied the opinions that people express when they are asked, in a variety of ways, to evaluate hazardous activities, substances and technologies (Slovic, 1987). This perspective assumes that the majority of people rely on intuitive risk judgements, typically called 'risk perceptions', and attempts to develop techniques for determining the factors underlying these judgements. A major development in this area has been the measurement of the relative influence of different cognitive factors such as 'mental strategies' or 'heuristics' (e.g. Kahneman et al., 1982). This literature has identified more or less persistent biases in people's ability to draw inferences from probabilistic information. In particular, psychological experiments have shown that "difficulties in understanding probabilistic processes, biased media coverage, misleading personal experiences, and the anxieties generated by life's gambles cause uncertainty to be denied, risks to be misjudged (sometimes overestimated and sometimes underestimated), and judgement of fact to be held with unwarranted confidence" (Slovic, 1987, p. 281). This literature has further indicated that initial perceptions about risks are resistant to change (Nisbett & Ross, 1980) and that presenting the same information in different ways, like using positive or negative language, alters people's perceptions and actions (Tversky & Kahneman, 1981).

Some psychology-based researchers have also used a psychometric approach to develop different hazard taxonomies that can be used to understand and predict responses to risks (Fischhoff et al., 1978; Slovic et al., 1984; Starr, 1969). This approach makes use of psychophysical scaling and multivariate analysis techniques to produce quantitative representations or 'cognitive maps' of risk attitudes and perceptions. In this literature, people make quantitative assessments of the current

and desired riskiness of different hazards and the desired level of regulation of each of them. These assessments are then related to assessments of other properties such as: "(i) the hazard's status on characteristics that have been hypothesized to account for risk perceptions and attitudes (for example voluntariness, dread, knowledge, controllability), (ii) the benefits that each hazard provides to society, (iii) the number of deaths caused by the hazard in an average year, and (iv) the number of deaths caused by the hazard in a disastrous year" (Slovic, 1987, p. 821). This literature views the hazard "as the independent variable and people's response to it as dependent" (Douglas, 1985, p. 25) and contrasts different groups of people's perceptions of risks such as lay people and experts.

The psychometric literature has shown that the concept of 'risk' has different meanings for different people and depends on different variables that shape individual risk estimations and evaluations (Gilovich et al., 2002; Slovic, 1987). The literature, for example, has shown that lay people perceive risks closer to them as being more serious than do experts whose assessments, on the contrary, are more consistent with technical estimates on fatalities (Slovic et al., 1980). It has also been shown: that people are willing to tolerate higher degrees of risks from voluntary activities than from involuntary hazards and from activities seen as beneficial rather detrimental (Starr, 1969); that perceived characteristics such as familiarity, control, catastrophic potential, equity, and level of knowledge also seem to influence the relation between perceived risk, perceived benefit and risk acceptance (Fischhoff et al., 1978); that dangers or hazards that carry the highest signalling value also carry the highest perceived seriousness, which further correlates with the amount of media attention (Slovic et al., 1984); that people's general mood affects risk perception (Johnson & Tversky, 1983); and perhaps most of all that per-

ceived risks are quantifiable and predictable across different groups that all have concerns that need to be taken into account (Slovic et al., 1982; Slovic, 1987).

The literature in the rationalist-cognitive risk paradigm regards individuals as calculating and emotion-free actors and assumes that they share the same responses and preferences as those held by the actors in utilitarian philosophy (Lupton, 1999, p. 22; Renn, 1992, pp. 58-59). "In examining the individual's response to risk, this research provides a subjectivist interpretation within a realist paradigm", according to Bradbury (1989, p. 384). This assumption, however, has often been the source of critique and limitation. In economics, for example, decisions on risks are often considered to be collective that require aggregation of individual utilities; but because utilities are subjective, they cannot be averaged by means of any logically valid method (Renn, 1992, p. 62). It might also be that transactions impose risks (externalities or social costs) on third parties who might not benefit from those transactions, but due to the same narrow individualistic focus this tends not to be taken into account. It also happens that people, out of compassion, sacrifice their own interests to the benefit of others, something which goes against the rationalist paradigm. In a similar vein, the psychological research on risk management, due to its strong emphasis on the individuals expressed preferences, judgements, and perceptions, also has trouble aggregating these into any logically consistent whole.

The literature also contains an inherent epistemological inconsistency. It perceives risks as being objective facts, but rather than studying the risks "out there", the current literature in this paradigm studies people's perceptions or expected utilities (Bradbury, 1989). If people always perceive and behave rationally, as it is assumed by the rationalist-cognitive risk paradigm, then inferences from this seem

possible. In this respect, however, studies have shown that people do not always process information or structure decisions rationalistically (Schoemaker, 1982). The rationalist-cognitive perspective also disregards the symbolic meanings that humans give to things, events and risks. It confines the concept of perception to mean how humans see and understand the world through their senses and brains, without acknowledging the ways in which cultural conceptual categories mediate that assessment. It thus fails to examine how risks are constructed as social constructs, "for the nature of risk is taken for granted" (Lupton, 1999, p. 18). In this paradigm "there is an unintended emphasis on perceptual pathology", as Douglas writes (1985, p. 3). People tend to be positioned outside cultural or political frames within which interactions take place and within which beliefs, relationships and emotions are forged and identifies shaped. This is convenient for psychometric statistical testing and modelling and for distributing probabilities over time, space and context, but it reduces and over-simplifies such phenomena (Lupton, 1999, p. 23).

In summary, the rationalist-cognitive risk paradigm has thus contributed to the current risk management literature by producing strong and very often complex mathematical models used to calculate risk probabilities and consequences. The understanding of 'risks' as objective facts and the management of such facts as danger prevention has allowed calculations of both societal and organisational risks (Renn, 1998). The cognitive literature has contributed to this by pointing out mental biases and contrasting different views of risks across different groups of people such as experts and laypeople. This literature has allowed more advanced studies on models that have taken this into account and attempted to develop more sophisticated methods to avoid the limitations of the human being. The strength of this paradigm, however, has also been its limitations, and the literature has pointed

to several limitations in its presumption of human beings as rationalist and utility-optimising. In the same vein, the literature has pointed to potential limitations, as the paradigm has lost focus on the contextual factors such as social and cultural structures by not engaging in examining risk management as a 'situated social practice', i.e. "as an activity that more or less skilful people in organizations do in particular ways given particular contexts" (Chua, 2007, p. 489).

3.1.2. Functionalist risk paradigm

Another stream of literature which is strongly represented in the management accounting and project management literature on 'risk' and 'risk management' can be classified into what I term a functionalist risk paradigm. Like the rationalist-cognitive risk paradigm, this literature understands 'risks' as being objective facts that have to be identified, assessed and reduced through structured and "scientific" approaches. However, in contrast to the rationalist-cognitive risk perspective, which focuses on human perception of risks and statistical modelling of occurrences and consequences, this literature focuses on practices of risk management. In addition, this literature understands practices of risk management as being functional systems that it is imperative for organisations to adapt in order to satisfy fundamental organisational needs. In relation to risk management, these needs would be the reduction, avoidance or elimination of risks that prevent the organisation from reaching its objectives or otherwise hamper organisational processes. It also builds on the premise that explanations of this imperative lie in situational causation rather than in the consciousness of actors (Donaldson, 2003, pp. 44-45). This perspective thus holds that internal and external situations, also known as contextual factors or contingencies, determine the most optimal way organisations should structure, for example, their practices of risk management.

In explaining this major assumption, the functional paradigm posits that if organisational decision-makers fail to adapt practices of risk management in ways that best fit the situation and produce the best outcomes, the organisation will suffer from suboptimal risk performance (Donaldson, 2003, p. 45). If this suboptimal performance persists over longer periods of time, this will lead to pressure on management to restructure the practice. This pressure, however, does not come from cognitive biases, although they may have been the cause of suboptimal performance, but from external factors such as market competition. If organisations are unable to compete over longer periods of time, they tend to be eliminated from the population, and because management and managers rarely want to lose their jobs, this produces a strong incentive to adapt the practice of risk management to better fit the situation. "Going further, because organizational decision-makers are forced by the situation and the performance imperative to adopt a particular option, they may do so even if it runs counter to their thinking" (Donaldson, 2003, p. 46). This means that the situation will determine the structure without any kind of moderation by managerial ideas; there will be "an irresistible tendency for organizational managers to choose options that conform to the situational imperative" (Donaldson, 2003, p. 45).

The literature in this paradigm has largely been focused on explaining the contextual factors or contingencies that determine the risk situation of the organisation, and also how practices of risk management relate to notions of performance and value. This literature has thus generally sought to explain systematic differences between practices of risk management with reference to varying contextual factors. One of the first accounting studies that attempted to do this was Liebenberg and Hoyt (2003), who looked into the financial and ownership characteristics of US firms by comparing firms that had adopted holistic risk management between

1997 and 2001 with a size- and industry-matched control sample consisting of firms that had not adopted holistic risk management. While their findings suggested that these characteristics had little influence on the structure of risk management practices in both the sample and control firms, they did find that firms with greater financial leverage were more likely to appoint a chief risk officer. As earlier studies had found that chief risk officers were more likely to reduce the costs associated with the 'risk-shifting problem'[5] and to communicate the firm's risk profile to external stakeholders, they concluded that firms with greater financial leverage were more likely to achieve these benefits as well.

Other early functionalist accounting studies on risk management have also looked into factors that could determine differences between practices of risk management (Beasley et al., 2005; Colquitt et al., 1999; Kleffner et al., 2003). Colquitt, Hoyt and Lee (1999), for example, found that factors such as firm size, firm industry, and the background and training of the risk manager determined the degree to which holistic risk management had been adopted; Kleffner, Lee and McGannon (2003) showed that encouragement from the board of directors, the influence of risk managers, and compliance with stock exchange guidelines were three main factors that explained the adoption of holistic risk management; and Beasley, Clune and Hermanson (2005) found that the stage of risk management implementation was positively related to the presence of a chief risk officer, board independence, apparent support for risk management from the chief executive officer and chief financial officer, the presence of a Big Four auditor, entity size, and enti-

[5] "Shareholders have an incentive to alter the firm's risk profile after contracting with fixed claimants such as debt holders. Because debt holders anticipate such behaviour, they increase their required rate of return on credit provided to the firm… ERM [enterprise risk management, also known as holistic risk management] systems provide a way for firms to make a credible commitment against such behaviour because they facilitate better disclosure of the firm's risk exposure" (Liebenberg & Hoyt, 2003, p. 43).

ties in the banking, education, and insurance industries. All of the above were explorative studies, however, based on questionnaires sent out in national contexts, but they did take into account a variety of both public and private sector actors.

In contrast to the above two studies, Woods (2009) attempted to develop an actual contingency theory on risk management by looking in more detail into the determinants of one risk management practice over a longer period of time. She examined the Birmingham City Council's risk management practice and found that this practice, including its adopted control system, was dependent upon three core contingencies: central government policies, information and communication technology, and organisational size. She argued that these contingencies determined the selection and operation of risk management practices, including their control systems. In 2011, Collier and Woods (2011) attempted to move forward that contingency theory by testing Woods' three contingencies by means of a transnational comparison of four UK and Australian local authorities (two large, two small). In short, they found that these three contingencies were indeed significant for differentiating practices of risk management, but only comparatively within the same national context, not across these as anticipated. Collier and Woods further tested their findings against the explanatory power of other theoretical perspectives (institutional, resource dependent and political). They concluded that contingency theory provided an incomplete explanation of how risk management control systems developed and called for more pluralistic approaches to the study of risk management.

The literature has also studied the contextual factors that determine the relation between practices of risk management and the performance of firms. Gordon, Loeb and Tseng (2009) examined 112 US firms that disclosed the implementation of

their risk management activities in their 2005 reports to the US Securities and Exchange Commission. They found that the relation between risk management and firm performance was contingent upon the proper match between risk management and the following five contingencies: environmental uncertainty, industry competition, firm size, firm complexity, and monitoring by the board of directors. Hoyt and Liebenberg (2011) further modelled the determinants of the adoption of risk management and the effects of risk management on firm value in the insurance industry. They looked into the disclosures on risk management made by 117 publicly traded US insurance companies over an 8-year period from 1998 to 2005. They came to the conclusion that risk management did indeed enhance firm value and that the following factors determined the degree of its adoption: firm size, firm leverage, firm asset opacity, external stakeholder pressure, the hedging of risks through reinsurance, life insurers, reduced firm market value over time, and international firm diversification (Hoyt & Liebenberg, 2011, pp. 805-810).

While the above literature focused mainly on US firms and on enterprise risk management implementation at an aggregate level, Paape and Speklé (2012) examined the implementation of enterprise risk management in 825 Dutch headquartered organisations. Their findings showed (1) that in consistency with earlier studies, the extent of enterprise risk management implementation was determined by regulatory environment, internal factors, ownership structure, and firm and industry-related characteristics; (2) that perceived risk management effectiveness was associated with the frequency of risk assessment and reporting, as well as with the use of quantitative risk assessment techniques; but also (3) that no evidence was present suggesting that the application of COSO ERM improved effectiveness, and that the quantification of risk tolerances (the risk appetite), the involvement of lower levels of management, and having retrospective data or

prospective information contributed to this. Paape and Speklé thus contributed by extending the findings of earlier US-based findings to European organisations, thus creating a more solid contingency theory on the implementation of (enterprise) risk management, but perhaps primarily by exploring the relationship between specific enterprise risk management design choices and perceived risk management effectiveness.

Lastly, the literature has also been engaged in demonstrating the effectiveness of different risk management models compared to different contextual factors (See Imbeah & Guikema, 2009, for a review of these highly technical different models). This literature has primarily focused on describing different types of risks related to large projects and how well the different models have been able to take these into account. In other words, this literature has focused on determining the optimal model compared to differentiated risk settings related to large projects. Imbeah and Guikema (2009), for example, although focusing primarily on promoting one type of model, compare the effectiveness of different models with their ability to take into account three types of risks: 'budget risks', 'schedule risks' and 'technical risks'; and Liu, Wehbe and Sisovic (2010) compare the accuracy of different 'hybrid approaches', referred to as approaches tailored to the organisations' unique operating environments, with 'conventional fixed contingency approaches'. The latter refers to generic approaches such as subjective judgement, sensitivity analysis, real options analysis and Monte Carlo simulations (Akintoye & MacLeod, 1997). They find that the average accuracy of different types of projects completed using 'hybrid approaches' compares significantly favourably to the 'conventional fixed contingency approaches' and propose a reliance on the former rather than the latter.

The above studies have all indicated that much can be learned from studying the contexts surrounding organisational practices of risk management, and that specific factors such as organisational size seem to influence the development of such practices. As in the case of the rationalist-cognitive risk paradigm, however, the functionalist research also neglects the effects of social, cultural and political relations. This means that the studies that draw on this perspective, or on the rationalist-cognitive perspective, lose sight of how associations, institutions, beliefs, etc., may affect how risks are understood and negotiated. In the functionalist perspective, these elements tend to be dismissed as disturbances that might affect single entities but over time lose their effect, as organisations tend to be driven much more by functional mechanisms such as its survival. If, for example, one group of actors disagree with the way risk management is practised, and, all other things being equal, hold the social position to change it, this will be irrelevant from the functionalist perspective if stock exchanges' listing requirements say otherwise and the organisation wishes to remain listed. Over time this situational imperative will crowd out the effects of the beliefs of these actors, as the situation leaves them open to sanctioning, and possibly replacement, by their supervisors.

The functionalist paradigm thus assumes that in the long term, people end up behaving rationalistically, and that systems or practices of risk management move slowly towards an optimal and most effective structure through mechanisms of selection and adaption. It assumes that problems related to risk management must be caused either by suboptimal models or by "implementation deficits and operational friction" (Power, 2009, p. 849). Whatever is the case, this assumption helps to justify the argument for developing more accurate models; because if persistent deficits or frictions exist, this must be because the optimal model has not been applied. This perspective does not take into account that perhaps the absolutely op-

timal risk management system does not exist, as all actors without exception are immersed in socio-cultural settings and thus that all systems might be "sub-optimal". It further simplifies the function of risk management to deal only with improving organisational effectiveness, which it equals to value generation and thus does not take into account that risk management could also be about generating other effects such as disciplining managers or justifying managerial decision-making. Collier and Woods (2011) indicated this by arguing that contingency theory represented an incomplete approach and had to be supplemented by different approaches.

3.1.3. Social constructivist risk paradigm

In later years, the literature on risk management has begun to examine the social and cultural significance of 'risk' and 'risk management', something which has also had an effect on the literature on management accounting and project management. This literature has emphasised the very aspects that the rationalist-cognitive and the functionalist risk paradigms have disregarded or downplayed as less relevant (Gephart et al., 2009; Lupton, 1999). This literature has focused on the ways in which cultural structures, categories and hierarchies serve to define knowledge and practices of risk management, how notions of risks are used to establish and maintain conceptual boundaries between groups of people, how macro-social processes relate to the emergence of risk and risk management ideas, how risk and risk management serve to discipline groups of people, how humans give meanings or experience risks in micro-context, and similar areas (Lupton, 1999, pp. 24-34). In the following I identify three risk paradigms that this literature in my view can be divided into, based on the current risk management literature relevant for management accounting and project management. I have termed the first one *the social constructivist risk paradigm* because it focuses on explaining risk manage-

ment practices as constructions made by humans. I acknowledge the argument that this risk literature could have been subdivided even further into more detailed categories (See Renn, 1992).

In describing the theoretical assumptions of the social constructivist risk paradigm, the literature in this paradigm considers risks as always being embedded in human-constructed cultures that give them meaning (e.g. Douglas, 1985; Douglas & Wildavsky, 1983). In comparison with the rationalist-cognitive and the functionalist risk paradigms, this literature also considers risks as facts or effects of events "out there". In contrast, however, this literature maintains that because our perception of risks is always embedded in cultures, they cannot be termed objective, constant or individualistic. It assumes that what we identify, measure and manage as risks are always constituted on the basis of our pre-existing knowledge: "Although the material and social worlds are experienced by most individuals as objective, pre-existing realities, these realities involve the reproduction of meaning and knowledge through social interactions and socialization and rely upon shared definitions" (Lupton, 1999, p. 29). Seen from this perspective, risks are always constructed and negotiated as part of larger networks of human beings and their interactions; they are always the product of value-dependent world views. So-called "expert judgements" of risks are no more "objective", "neutral" or "unbiased" than those of other groups of people, such as laypersons; they are also constructed through cultural and social processes.

In contrast to the rationalist-cognitive and functionalist risk perspectives, the literature in this perspective thus largely focuses on examining how concepts of risks are part of different world views and describe the dynamics related to this (Lupton, 1999). This literature does not reject the notion that decisions based on

statistical probabilities can be beneficial compared to specific risk decisions, but it maintains that these decisions will be too narrow to be used as a basis for social acceptability (Bradbury, 1989). As the acceptability of risk management depends on the values of those involved and influenced, and because different people hold different values, risk management must take cultural and social aspects into account. If not, tensions, conflicts and resistance can emerge which may reduce risk management effectiveness. In addition, rationalistic models per se cannot merely be considered "cognitive aids for the individual decision maker", but "should be regarded as shared conventions, expectations and cultural categories that are founded on clear social functions and responsibilities" (Douglas, 1985, pp. 80-81). In the social constructivist risk paradigm, the focus of investigation thus changes from the individual's risk perceptions and the improvement of rationalist risk management models to that of social processes, rationalities, beliefs, institutions, policies and values (Renn, 1992, p. 71).

One of the significant contributions in this paradigm has been made by Anette Mikes, who sought to explain the differences between the risk management practices of large banking organisations in apparently similar situations (Mikes, 2009, 2011). Mikes (2009) presented field-based evidence from two large banking organisations which showed systematic variations between risk management practices. In explaining this, Mikes pointed towards the existence of different 'alternative logics of calculation' or what she conceptualised as 'calculative cultures'. She defined these as "senior managerial attitudes towards the use and implementation of highly analytical calculative practices" (Mikes, 2009, p. 21), and found that these calculative cultures in practice were polarised around the enthusiasm or scepticism towards risk measurement and modelling. She termed the former calculative idealism, in which the adherents aimed at managing risk through quantifica-

tion and modelling, and the latter was termed calculative pragmatism, where adherents relied more on judgement, experience and feelings and often distrusted numbers. In showing this, Mikes also bordered the functionalist paradigm as she argued that calculative cultures did not only shape perception of risks, but also *determined* management predilections towards risk management and served as "important constituents of the fit between risk control systems and organizational contexts" (2009, p. 20).

Mikes (2011) later confirmed her initial findings through an extended case study involving another five banking organisations. She found that relentless risk measurement was contingent on her earlier termed calculative cultures. "While the risk functions of some organizations have a culture of quantitative enthusiasm and are dedicated to risk measurement, others, with a culture of quantitative scepticism, take a different path, focusing instead on risk envisionment" (Mikes, 2011, p. 226). In addition, she attempted to explain the dynamics of the development of these alternative cultures by examining the boundary work of risk experts (Mikes, 2011). She found that risk experts were important for understanding the expansion and limitation of the different types of calculative cultures. The quantitative-enthusiast risk experts, for example, expanded what she termed first-order measurements (initial risk quantification) into new domains of risk, and used these measurements to create second-order measurements (risk aggregation), which could not only be used for risk-adjusted performance but also to expel other groups of actors that "trespassed" on their domain. These experts created new manageable realities which, in turn, could be the objectives of economic calculation and "*protected their autonomy* and helped them defect criticism and displace blame in the face of apparent risk management failures" (Mikes, 2011, p. 241).

In contrast, Mikes (2011) found that the quantitative-sceptic risk experts combined first-order measurement with what she termed 'envisionment' practices based on the controller's own mental models, prior experience and intuition. These experts expanded softer techniques such as discussion forums into the envisionment of non-calculable strategic risk objects and produced alternative future scenarios and expert opinions on emerging risk issues. They "de-emphasized risk models in decision making; they saw their roles as devil's advocates, searching for relevant intelligence and channelling it to the apex of the organization" (Mikes, 2011, p. 41). In contrast to the quantitative-enthusiast experts, however, these controllers lacked analytical mystique, which weakened their position as a distinct expert group. This in turn left the boundaries between them and the rest of the organisation blurred and porous, but because decision-makers in the business lines found their assessments more relevant for "getting things done", their success as experts was maintained. In summing up her findings, again showing her social constructivist but also functionalist risk approach, Mikes concluded that "the boundary-work of risk experts is contingent upon the calculative culture they display and can result in very different styles and dynamics of risk control" (2011, p. 241).

In relation to the social constructivist risk approach, Mikes (2009, 2011) contributed by showing the importance of understanding the culture of different groups of actors (risk experts, top management) for constructing practices of risk management. In this respect, Wahlström (2009) added to the social constructivist literature on banking organisations by examining the perception of different banking staff groups of Basel II risk measurement requirements. Wahlström focused on how different groups of staff perceived the strengths and weaknesses of Basel II's risk measurement requirements. He found that positive perceptions were generally supported by banking staff who worked directly with risk measurement, such as

risk managers, project leaders and headquarters staff directly involved in implementation. In contrast, negative perceptions were held by banking staff primarily involved in operational assignments, such as internal auditors, heads of retail divisions, and credit officers. In explaining this difference, Wahlström argued that "both groups are included to take account of information that meshes well with their existing frames of reference and are thus more included to value changes that accord with their own viewpoints" (2009, p. 53). In this respect, Wahlström conducted 25 interviews across four large Swedish banks, and his study represents an initial attempt to link different people's perceptions of risks with different organisational positions within banks in light of new regulatory requirements.

In the social-constructivist literature, I have also classified the literature drawing on institutional theoretical assumptions. One of the most comprehensive studies in the management accounting literature has been made by Arena, Arnaboldi and Azzone (2010), who studied three non-financial companies' risk management practices over a seven year period. Their findings contribute to our understanding of the trajectory of enterprise risk management implementation organisations as it encounters pre-existing logics. These trajectories, or dynamics, were found to be framed by three elements: (1) risk rationalities, which denote the discursive and visual domains that frame how uncertainties are conceptualised into risks; (2) the roles of those involved, which primarily include the chief risk officer, but also risk specialists, internal auditors and management accountants; and (3) technologies, which denote the complex set of practices, procedures and instruments enacted to accomplish the management and control of risks. In this sense, Arena et al. drew upon a social constructivist understanding of 'risks' as "those phenomena that are conceptualized and managed as risks" in contrast to that of 'uncertainties', which

for them were used to "denote the wider range of [objective] events that can affect the organization" (Arena et al., 2010, p. 660).

In more detail, Arena et al. (2010) found that enterprise risk management was realised in different ways across the three companies, depending on the risk rationalities, embedded actions of experts, and technologies, as the practice encountered pre-existing control practices. In the three companies, enterprise risk management was realised according to the risk rationalities of 'compliance', 'corporate governance', and 'pervasive performance', respectively. These rationalities shaped the conceptualisation of risks, "differently instilling an urgency to better understand and control future threats" (Arena et al., 2010, p. 671). These rationalities further entailed different structures of intentionality and programmatic actions, which were put into effect through, and later influenced by, the involvement of uncertainty experts. These experts sought to conduct and expand enterprise risk management through their embedded actions, which subsequently affected risk rationalities. This was not straightforward, however, as these actions were carried out in competition with pre-existing control practices and their experts, the pre-existing understanding of their roles, and the nature of their businesses. Lastly, this interplay between roles and rationalities was played out between more or less decoupled or embedded risk management technologies. Arena et al. found that the organisational meaning attributed to enterprise risk management differed depending on the adopted technologies, which in turn were determined by the experts' embedded processes of translation.

Within institutional theory still, Michael Power examined the proliferation of risk management, including its embedded calculable logics, and pointed to the strong influence of the accountancy profession (Power, 2004, 2007). Power (2004, 2007)

showed that risk management emerged alongside corporate financial scandals, which gave rise to principles of corporate governance and internal control standards. These principles and standards were largely developed and/or promoted by the accountancy profession, which led to an intensification of auditing and control processes. These processes were subjected to a 'logic of auditability', that is, "a logic in which the demand for things to be auditable and for things to be seen to be auditable are almost identical" (Power, 1996, p. 312). As corporate governance principles were implemented simultaneously around the world as part of stock exchanges' listing requirements (See Christiansen & Koldertsova, 2009) and government white papers, this led to increased legalisation and bureaucratisation of organisational management (Power, 2007). In turn, these demands generated new risks for reputation, so-called secondary risks, as risk management had become equal to good governance, and as organisations knew that poor reputation led to poor financial performance (Power, 2007).

Hayne and Free (2014) demonstrated how the process of arriving at this "best-practice worldwide status", defining the language of governance and senior management responsibilities, was anything but straightforward. Hayne and Free looked more closely into the relationship between COSO as an institution and the actors that were central in its formation and diffusion, or what they termed the supply side of risk management. They found that several forms of institutional work were applied, including theorising, rhetorical appeals, mythologising, and constructing normative networks and educations. This work was non-sequential, often serendipitous, and at times heavily reliant on a web of member entities. Hayne and Free contributed by showing that the emergence of the COSO ERM framework as the "ultimate" platform for risk management had nothing to do with "better", "optimal", or more "effective" types of risk management, but had every-

thing to do with the interests of what they termed the "hybridized professional group" that ended up being involved in promoting the concept. In this respect, literature has shown that risk management has turned out to become a pervasive logic of organising to legitimise organisational actions (Power et al., 2009).

Other studies have engaged with the linkages between risk management and auditing to demonstrate how business risk auditing emerged on the basis of the growth of risk management theories and processes (Knechel, 2007); how business risk auditing legitimised and widened auditors' jurisdictional claims over other areas of expertise through i.a., embedding the logics of risk management in its methodologies (Robson et al., 2007); how internal auditors seized the new opportunities that emerged with the reinvention of internal control as risk management to present themselves as risk management experts (Spira & Page, 2003); and how auditors' risk assessments were driven by the fear of making mistakes and how cognitive processes are mobilised and defence strategies deployed to change that fear into a feeling of comfort (Guénin-Paracini et al., 2014). To sum up, these studies have contributed by pointing out the close linkages between auditing and risk management developments during the last decades the general (risk) work of auditors. The latter study has even supplemented social constructivism with a psychodynamic perspective by also exploring the things "beneath" the actor's actions "in the deep and autonomous structures of subjectivity" and the interplay with auditing (social) practices (Guénin-Paracini et al., 2014, p. 285).

Outside the literature on auditing, but still within the management literature, Collier and Berry (2002) conducted four comparative case studies with the aim of understanding how managers perceived and managed risks in the budgeting process. In short, they found that managers created their own domains of risks which

shaped their perception, but also that these were isolated from the budgeting process, which was dominated by (non-risk) target setting, and even more from the actual content of the budget, from which risks were excluded. In the four cases, during the process of making the budget dependent on the constructed risk domains the companies thus considered a number of risks, but ended up excluding them. In sum, this reflects the more general behavioural finding of March and Shapira (1987), who found that managers indeed took risks and exhibited risk preferences, but that the processes that generated those observables were "somewhat removed from the classical processes of choosing from among alternative actions in terms of the mean (expected value) and variance (risk) of the probability distributions over possible outcomes… Managers are quite insensitive to estimates of the probabilities of possible outcomes; their decisions are particularly affected by the way their attention is focused on critical performance targets" (March & Shapira, 1987, p. 1404).

To sum up, the social constructivist literature has contributed by demonstrating the importance of understanding that all risk management practices are mediated by the institutional or social environments within which they are implemented. The different understandings that groups of actors hold of 'risk' and 'risk management' may determine how risks are constructed, managed and reduced. These understandings have further been shown themselves to undergo changes over time as they encounter pre-existing rationales of other people, different predilections towards quantification, and organisationally embedded technologies. This perspective has also shown how the institutional work of people involved in risk management shapes the proliferation of risk management standards. In contrast to the functionalist risk paradigm, literature reflecting this stand has shown how this has happened for reasons other than a 'situational imperative', but from institutional

work mainly carried out by the accountancy profession which has shaped the logics of risks and its necessity. This has also contrasted the rationalist-cognitive risk paradigm as models, such as the COSO ERM, have expanded not due to their accuracy or lack of bias, but due to the pervasive influence of institutions on human behaviour and understanding through rules and norms.[6]

The social constructivist risk paradigm gains strength from the acknowledgement that cultural and social environments, institutions, etc., affect how people understand risks and thus have to be taken into account (Douglas, 1985; Lupton, 1999). This strength, however, has also been argued to be its main weakness. It has often been claimed that "theory is to be judged by its predictive powers" (Friedman, 1953, p. 8), but because social constructivists tend to examine "only" a few practices, they are unable to generalise across contexts. From this perspective, theory-building thus becomes problematic, and social constructivists often have to be content with "only" providing (detailed) context-relevant findings. In contrast, both the functional and the rationalist-cognitive risk paradigms derive their strength from attempting to produce predictive theories/models that can be generalised across much wider contexts. This may lead to simplified, biased and superficial models, as argued by socio-cultural researchers, but because people need models for large scale decision-making in order to reduce uncertainty, an inaccurate model may still be more useful than none (Millo & MacKenzie, 2009). The social constructivist risk paradigm thus suffers from the "weakness" that generalisation becomes problematic, that is, unless based on comprehensive case studies.

[6] In the social constructivist risk paradigm there have also been lengthy discussions, going back several years, on risk and blame (e.g. Douglas, 1985). These discussions have also taken place in the management literature (e.g. Hood, 2002; 2007) and accounting (e.g. Skærbæk and Christensen, forthcoming). I have decided to leave the notion of blame outside the scope of this dissertation as I did not find evidence of such aspects at present.

Another limitation has been pointed out by (pure) constructivists. It follows that the literature within the social constructivist risk paradigm has treated notions of risks as representations of events "out there" and not as pure constructions. It has thus approached the notion of 'risk' *through* the perception of them held by groups of people, treating perceptions and definitions of risks as the dependent variable (Hilgartner, 1992). This makes the social constructivist fall short by the same critique as the rationalist-cognitive risk paradigm did, only for the individual, who was here also treated as the dependent variable (Douglas, 1985). "Treating perceptions and definitions of risk as the dependent variable… leads to a one-way analysis that neglects the dynamics of technological change" (Hilgartner, 1992, p. 39). It neglects the finding that risk and risk management become incorporated into technologies and shape their evolution. In Kaplan et al.'s (2009): "Managing Risk in the New World", for example, Mikes, who examines risk management from a social constructivist perspective, states that: "Models are not decision makers: people are. So the real issue is the culture that you have around modelling" (Kaplan et al., 2009, p. 70). It is statements like the above that have been critiqued by constructivists for downplaying the importance of technologies.

3.1.4. Structuralist risk paradigm

As mentioned earlier, I identified three risk paradigms within the larger sociocultural risk paradigm into which contemporary risk management literature can be classified. The section above dealt with the social constructivist risk paradigm, and this subsection deals with what I have termed a structuralist risk paradigm. This paradigm bears many resemblances to the social constructivist perspective, but it also diverges in important aspects. Like the social constructivist literature, this literature, for example, also assumes that underlying structures, institutions, etc., define the knowledge of 'risk' and 'risk management'. In contrast to the focus of so-

cial constructivists on "micro"-social practices, however, the literature in this paradigm focuses far more on "macro"-social processes. The literature in this paradigm sees these as characteristic of late modern societies and examines the linkage between them and the concepts of 'risk' and 'risk management'. These processes include "reflexive modernization, or the move toward criticism of the outcomes of modernity, and individualization, or the breaking down of traditional norms and values" (Lupton, 1999, p. 25)[7]. This subsection focuses on the insights primarily offered by Ulrich Beck (e.g. 1992b, 1999) and Anthony Giddens (e.g. 1991) and how they have contributed to our understanding of 'risk'.

In the structuralist risk paradigm, Beck has become one of the most prominent figures referred to by academics when characterising modern society's perception of 'risk' and 'risk management' (Gephart et al., 2009). Beck characterised modern (western) societies as transitional societies marked by their overlapping concern with both the distribution of scarce 'goods', such as wealth or employment, and the distribution of risks. He termed societies preoccupied with the distribution of risks for 'risk societies' and argued that modern societies were heading towards becoming still more concerned with this. He also identified two key conditions that explained this: (1) the attained level of productivity and the persistence of the welfare state; and (2) the explosion of new risks brought about by increased levels of productivity like pollution, toxins, radiation etc. (Beck, 1990). In short, Beck thus argued that risks were self-made by humans, increasing, and caused as a "by-

[7] "At its simplest, modernity is a shorthand term for modern society or industrial civilization. Portrayed in more detail, it is associated with (1) a certain set of attitudes towards the world, the idea of the world as open to transformation by human intervention; (2) a complex of economic institutions, especially industrial production and a market economy; (3) a certain range of political institutions, including the nation-state and mass democracy: Largely as a result of these characteristics, modernity is vastly more dynamic than any previous type of social order. It is a society – more technically, a complex set of institutions – which unlike any preceding culture lives in the future rather than in the past" (Giddens & Pierson, 1998, p. 94).

product" by the very same processes of modernisation that had solved years of 'goods' distribution problems. The central problem would now be to manage risks so "they neither hinder the process of modernization nor oversteps the limits of what may be reasonable accepted" (Beck, 1990, p. 53).

Beck also understood risks as real threats or dangers "out there", albeit man-made, and argued that they had developed into becoming "irreversible threats to the life of plants, animals, and human beings" (Beck, 1992b, p. 13). He argued that risks no longer could be confined within the boundaries of nation states, like the effects of the nuclear meltdown of the Chernobyl power plant; that they had come to elude direct human perception, like chemical toxins; and that they often caused systemic and irreversible damage, like radiation. "Even the rich and the powerful are not safe from them, not only as health hazards, but also insofar as they endanger legitimization, possessions, and profit" (Beck, 1990, p. 54). To make things worse, he argued, the magnitude and global nature of risks was such that risks were becoming more and more difficult to assess and reduce or avoid (Lupton, 1999, p. 62). Beck sympathised with the rationalist-cognitive risk paradigm as "hazards require natural-scientific categories and measuring instruments in order to be "perceivable" at all" (Beck, 1995, p. 162). As risks had become non-localisable with long-term unforeseeable effects and complex causes, however, rationalistic calculations were now poor strategies for dealing with risks; the demands for rationalisation might even have increased rather than decreased general uncertainty (Beck, 2009).

Beck further argued that the increased amount of risks could be attributed to human activity and increased levels of human knowledge compared to pre-modern societies where risks like famines, natural disasters and plagues were attributable

to “the looming power of gods and demons” raining down on mankind from the “outside” (Beck, 1992a, p. 98). Flooding, for example, can be traced back to the effects of global warming, which in turn can be traced back to carbon dioxide pollution, which in turn can be traced back as a “by-product” of factories, ships, aeroplanes, cars, etc., which all represent consequences of industrialisation, which has been brought about as the result of human activity / decision-making. Beck also argued that because risks were man-made, it was also the responsibility of people, firms, state agencies and politicians to prevent or reduce them. These actors all influence the production and distribution of risks through the decisions they make, the decisions made by political groups being those with the “toughest” consequences. Beck argued that ‘risk management’ becomes the large-scale political and societal practice where organisations and political groups come to struggle over the risks and how to distribute them.

Beck introduced the notion of ‘reflexive modernization’ to describe his observation that because risks had been “induced and introduced” by modernisation, they could also be controlled and reduced through political intervention (Beck, 1992b, p. 21). He described the concept of risk as being related to reflexivity, because anxieties about risks served to pose questions about current societal structures and thus induced motivation for change. The concept, however, did not merely denote ‘reflection’, but also ‘self-confrontation’ or the observation that modern risk societies had come to understand themselves as (world) risk producing entities (Beck, 1999). For Beck, this critical reflection on the dangers of industrialism and modernisation constituted the difference between industrial societies and risk societies and was what would lead to the “possibility of a creative (self)-destruction for an entire epoch: that of industrial society” (Beck, 1994, p. 2). He argued that what we thought to be scientific progress had now turned modern societies on the path to

self-destruction as an unintended consequence of modernisation. In turn, this had increased uncertainty for people as old societal structures were crumbling, questioned scientific progress and inventions as many new risks had been caused by these, and created conflicts between those producing risks (experts, industries etc.) and those consuming them (citizens).

The concept of reflexive modernisation is closely related to that of individualisation, which is also important to Beck's view of modern societies. Individualisation means that with modernisation, people now have to produce their own biographies, as traditional norms and certainties are absent (Beck, 1994, p. 13). Individualisation is the other side, the private side, of reflexive modernisation. Beck described how modernisation brought with it a transformation that removed previously accepted social roles such as gender and social classes. Individualisation is thus an outcome of modernisation processes, both re-structuring older societal institutions but also re-structuring how people ought to construct themselves as individuals. It is further dependent on decision-making, as it assumes agency, or "the ability to shape one's destiny through self-determination and identification" (Lupton, 1999, p. 70). It involves freedom to choose, but freedom in conformity with internalised demands of choosing. It was once fixed or pre-determined what one had to do with one's life, such as fixed roles in family, marriage, work, education, all determined by societal structures, but these roles are now left open to choice. This means that people now pursue their own interests, and this generates new uncertainties; to choose the wrong kind of university degree, to get divorced, to become unemployed, etc., represent the individual's failure as a human being rather than the result of broader social patterns. In turn, this turns 'risk management' into an everyday practice that all human beings have to undertake to avoid insecurity, anxiety, unease, or simply to avoid failing in the aspects of life.

Beck's work shares many similarities with that of Anthony Giddens. Giddens also saw modernisation as being characterised by the two extremes of globalising influences on the one hand and personal dispositions on the other (Giddens, 1991, p. 1). Giddens argued, like Beck, that late modernity was characterised by the breakdown of traditional roles, norms, habits, etc., and that this had an effect on the conduct and meaning of everyday life. In contrast to Beck, however, Giddens stressed modern institutions as the key to the nature of these characteristics, rather than the attenuation of basic human needs. Giddens argued that modern institutions had come to structure the individual's everyday life, but also that institutions were themselves structured by individuals' actions. "For Giddens the key features of modernity are institutional and individual reflexivity combined with the reorganization of time and space and the expansion of disembedding mechanisms" (Lupton, 1999, p. 73). He explained the latter to be mechanisms that take social relations out of their specific time/space context and apply them to wider locales, like expert knowledge systems. Such systems deploy "modes of technical knowledge which have validity independent of the practitioners and clients who make use of them" (Giddens, 1991, p. 18). Other disembedding mechanisms were symbolic tokens, like money, or objects with standardised values that serve as media of exchange.

In relation to the time-space continuum, Giddens argued that pre-modern societies were characterised by the coincidence of time and space dominated by localised activities, while modern societies had moved towards disconnecting space from location. In pre-modern societies, experiences and traditions were very much confined to specific localities, but with the rise of modernisation came also the bringing together of experiences and knowledge. Modern institutions were at the heart

of this movement, as they brought notions of "we" with them and thus unified people across the world. Giddens argued, much like Beck, that this drive for progress represented by modernisation, the globalisation and disembedding mechanisms, had led to an amplification of the effects of risks. If "the economy" goes wrong, for example, as with the recent financial crisis, this will affect billions of people rather than just one nation or one group of people. In this respect, Giddens argued differently than Beck. Giddens argued that due to modernisation, people had become more *aware* of the threats of the world and thus that risks were *thought* to be greater, while Beck claimed that modernisation had *actually* increased the amount of risks produced, which prompted the need to avoid them.

Giddens agreed with Beck that risks represented dangers or threats, that they were constructed by humans, humans who were part of modern societies, that the effects of them had been amplified, but not that they had increased in number. Giddens also termed modern societies "risk cultures" (Giddens, 1991, p. 3). However, Giddens disagreed with Beck when it came to the nature of 'reflexivity'. Giddens agreed with Beck that 'reflexive' referred to the increased self-awareness of both individuals and societies of the contingent nature of expert knowledge and social activity, but where Beck inferred that this had led to increased distrust of experts and societal progress, Giddens argued that the progressive separation of space, time and location and the disembedding mechanisms had led to a dependence on more trust. He argued that this, however, was not related to trust in people, but trust in abstract systems, like the system of expert knowledge. As Lupton writes: "People now cannot simply rely on local knowledge, tradition, religious precepts, habit or observation of others' practices to conduct their everyday lives… Rather they must look principally to experts they do not personally know and are unlikely to ever meet to supply them with guidelines" (Lupton, 1999, p. 75).

Giddens also argued that modern societies were characterised by doubts about the validity of these expert systems, because organisations and people had become more aware that experts tended to produce conflicting findings. In modern societies, as these conflicting findings were now spreading across the world at large, this held the potential to generate misleading knowledge and thus new uncertainties. In relation to risk management, for example, because organisations rely on worldwide expert (scientific knowledge) systems to produce reliable risk assessments of future hazards, and because experts (scientists) disagree on how to do this, such assessments end up becoming imprecise. In general, Giddens argued that such knowledge-ambivalence had led people to become more cynical and sceptical about modern society and the abstract expert (knowledge) systems. In pre-modern societies, reflexivity was largely structured by the traditions established within the time-space organisation of individual communities. In modernity, however, reflexivity has taken on a different structure that relies less on traditions to justify actions and much more on expert systems; but these produce conflicting findings which force people into becoming self-reflective. "Living in a "risk society" means living with a calculative attitude to the open possibilities of action, positive and negative, with which, as individuals and globally, we are confronted in a continuous way in our contemporary social existence" (Giddens, 1991, p. 28).

In summing up this subsection, the structuralist risk paradigm, here represented by Ulrich Beck and Anthony Giddens, has contributed by demonstrating how macro-societal developments have had an influence on the character of 'risk' and 'risk management'. Beck and Giddens have both contributed by showing how the notion of 'risk' has become a central concern in contemporary society emerging from the processes of modernisation. Risks are seen to have changed character

from being associated with “the forces of god or nature” to be the result of human decisions and actions, and therefore also human intervention. Beck and Giddens have also contributed by showing that ‘risk management’ has primarily become an activity of all organisations and individuals. As traditional structures have broken down, people and organisations need to reinvent themselves to succeed, and because risks follow as “by-products” of their decisions, they need to be contained. Both scholars have also pointed to the political nature of risks and risk management, singling out ‘reflexivity’ as a primary response to uncertainty. They may disagree on whether to trust or distrust experts, or expert knowledge, but both have showed that more extensive scepticism has followed scientific progress; both have showed that social conflicts and acts of negotiation now stand as central parts of any ‘risk management’ practice for humans as well as organisations.

Some major criticism has been directed at this perspective. Lash (1993) argues that reflexivity cannot only be understood through cognitive categories, but also has to be understood through aesthetics or hermeneutic self-interpretation. He argues that not all people have the freedom to construct their own narrative but often find themselves to be constrained by various elements such as their financial circumstances, geographical location, etc. It has also been pointed out that Beck and Giddens have derived their conclusions based on speculation rather than on empirical studies and thus know very little about everyday practices (Lupton, 1999). Thus they may have directed our attention to the importance of understanding risks as a modern phenomenon, but they provide little guidance as to how people should go about dealing with risks. As Hanlon (2010) further proposes: Beck’s understanding of expertise and knowledge “underplays the historical and contemporary importance of lay practice and knowledge, its relations with expertise and its long politicisation” (Hanlon, 2010, p. 217). Hanlon recommends that we return

to lay experience and social struggle to examine how people give meaning to risks, how they produce them and how they act upon them. See Lupton (1999) and Hanlon (2010) for further references to critiques of this risk paradigm.

3.1.5. Post-structuralist risk paradigm

The last of the three socio-cultural risk paradigms into which I have identified and classified current risk management literature can be termed a post-structuralist risk paradigm. This section describes the management accounting literature in this risk paradigm, albeit limited, and how this literature has contributed to our understanding of 'risk' and 'risk management'. Overall, these studies have been inspired by the work of Michel Foucault and have focused on concepts such as governmentality, discourse, dispositif, power and knowledge. Michel Foucault was concerned with how mechanisms of power affected everyday life (e.g. Foucault, 1970, 1977, 1981). He understood power not as something to be "acquired, seized or shared, something one holds on to or allows to slip away", but as relational, something that become apparent through being exercised (Foucault, 1981, p. 94). The concepts mentioned all deal with various aspects of this through approaches such as discourse analysis or genealogy study of developments over the course of history. Combined, the contributions to the literature in this perspective have primarily dealt with the notions of 'risk' and 'risk management', relying on these concepts to examine how 'risk' and 'risk management' relate to notions of power.

The post-structuralist paradigm must be distinguished from the structuralist paradigm. The structuralist risk paradigm has focused mostly on macro-structures that have led to the increased production of risks and/or the stronger awareness of them. In contrast, the post-structuralist risk paradigm focuses on the ways in which discourses, strategies, practices and institutions serve to bring risks into be-

ing (Lupton, 1999). The post-structuralists thus approach the notions of 'risk' and 'risk management', like other subject matters, from a meso-level structural perspective. In addition, this paradigm does not assume risks to exist "out there" mediated by human beings, as do the social constructivist and the structuralist risk paradigms, but as constructions produced through these discourses, strategies, practices and institutions. The literature in this paradigm assumes that discourses, etc., produce "truths" about risk, risk regimes, or risk dispositifs, which impinge upon social relations and become the basis for action. This literature claims that it is through these regimes or dispositifs that we know 'risk' and 'risk management'. In contrast, the structuralist paradigm claimed that modern societies were characterised by the freedom of agency led on by the processes of modernisation (structure) and rejected the idea of a *post*-modern society (Lash, 1993).

One of two studies identified drawing upon this understanding of 'risk' and 'risk management' comes from Michael Power, who has sought to explain the emergence of 'fraud risk' relying on Foucault's concept of 'dispositif' or 'apparatus' (Power, 2013). The concept of dispositif can be defined as a system of relations that can be established between "a thoroughly heterogeneous ensemble consisting of discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral and philanthropic propositions – in short the said as much as the unsaid" (Foucault, 1980, p. 194). Power argues that 'fraud risk', and its management, has emerged as a highly articulated, transnational web of ideas and procedures which frame the future within present organisational action. He further examines its broader historicity and argues that 'fraud risk' has emerged to become part of a more extensive risk management discourse for talking about, acting on, and governing organisations. This discourse – or more precisely dispositif or apparatus – consists of more than just

words, namely also of standards, rules, ideas, roles, procedures, routines, etc., all focused on 'risk' and risk control systems. He suggests that 'fraud risk' and 'fraud risk management' have turned into a 'regime of truth', a mechanism for governing and disciplining managers, "which has emerged from an expanding risk discourse and which shapes what it is possible to say with credibility" (Power, 2013, p. 542).

The above study by Power links to his earlier studies, which show how risk management has emerged alongside notions of corporate governance and internal control promoted by the accountancy professions (Power, 2007). "The language of organizational justification consists in being able to demonstrate conformity to standardized elements of a risk management system", as Power writes about what the developments have led to (2007, p. 185). In relation to this, 'fraud risk management' represents the latest particular and specific effect of this general rise of an expansive risk management process (Power, 2013, p. 541). In this way, 'fraud risk management' should not be mistaken for having been implemented by organisations attempting to adapt to an increased number of situations of people committing fraud, like academics within the functionalist risk paradigm would have argued, but rather as a new (post-modern) logic of organisation; a distinctive mode of governing the enterprise (Power, 2013, p. 541).

The second identified study focuses on how risk management as phenomenon has retained its importance after its "evident failure to manage risks" during the latest financial crisis by focusing on the notion of power (Huber & Scheytt, 2013). In doing this, Huber and Scheytt also rely on Foucault's concept of dispositif, but supplements this with Giorgio Agamben's notion of the "permanent state of exception" (Agamben, 1998, 2005). Like Power, they conclude that a strong risk management dispositif made out of institutions, regulation and models lies at the

heart of risk management. This dispositif shapes organisational balances of power as it reproduces larger societal values and determines organisational responses to 'risk'. In relation to Agamben's concept of "the permanent state of exception", the exception here being the financial crisis and the aftermath "the permanent state", this allows elites to "play" with people's fear and anxiety, which, in turn, may lead to even stronger calls for risk management – calls "which cannot be rescinded after the initial state of exception has ended" (Huber & Scheytt, 2013, p. 88). By this, they argue that risk management could be used as a powerful resource to augment, undermine or even replace other forms of management control.

The above two studies have contributed in general by showing how dispositifs have become means of ordering the social and material worlds through their methods of rationalisation and calculation of 'risk' and 'risk management'. These dispositifs have rendered uncertainty and disorder more controllable; they have brought 'risk' into being and therefore also the management of it either by institutions or by experts or consultants. The post-structuralist risk paradigm, however, also suffers from certain limitations. The question of how risk-related discourses and strategies operate, how they may be taken up, negotiated or resisted by those who are subjected to them, remains under-examined (Lupton, 1999). Huber and Scheytt acknowledge this when they admit that their "normative statements can be understood as idealistic, if not naïve", and explain that "the focus remains with more empirically focused research projects to deepen the analysis of the reasons for the continuing prominence of risk management" (Huber & Scheytt, 2013, p. 97). Foucault himself, however, said that he was simply not interested in such matters; he had no intention of second guessing specific actions at the individual or organisational (micro) level (See Power, 2013, p. 541).

Furthermore, the literature in this paradigm, including the above two studies, does not distinguish between one person and the next, but assumes that groups of people, such as managers, experts, etc., are the same. This literature thus downplays what the social constructivist literature has shown, namely that people are different and act differently depending both on the cultural settings and on their own preferences, interests, and the like. And this also applies to the literature taking the structuralist risk paradigm described here. For example, to conclude that "elites" can exploit the "permanent state of exception" brought about by the recent financial crisis to "augment, undermine or even replace more traditional forms of management control" is very speculative, as it leaves it to empirical studies to determine who these "elites" are – not to mention who the "non-elites" would be and how they could be defined. It does of course direct our attention to potential new ways of approaching 'risk' and 'risk management' and equip researchers with theories to do so, but when they are proposed detached from actual studies of practice, how useful can they be as guidance for empirical case studies? The post-structuralist risk paradigm thus gains strength when it focuses on the meso-level and does indeed do well in combination with institutional perspectives, but it has difficulties dealing with the examination of "micro" associations, differences between people, etc.

3.1.6. Constructivist risk paradigm

One more risk paradigm should be mentioned, which I have termed the constructivist risk paradigm. This paradigm has emerged especially in recent years, and it extends the social constructivist paradigm while still holding distinct theoretical assumptions that differ from that paradigm. It has a very strong focus on 'risks' as pure constructs made not only by human beings but also by non-human actors such as technologies, devices and tools, through complex networks of relations.

"A risk object, therefore, is not a static, objective phenomenon, but is constantly constructed and negotiated as part of networks of social interaction and the formation of meaning" (Lupton, 1999, p. 29). It also insists that analysis should be based on examinations of actual associations and not be pre-limited to "artificial" boundaries like 'an organisation' or 'a company'. This means carrying out examinations at the micro-level, which again differs from the structuralist and post-structuralist macro- and meso-level focuses respectively. It further a priori perceives the ability of different types of people, such as experts or lay people, to construct risks to be the same. It thus does not give priority to certain actors, either human or non-human, for understanding how risks are constructed.

The constructivist paradigm thus differentiates itself from the other risk paradigms. The rationalist-cognitive risk paradigm understood 'risks' as objective facts that had to be identified through structured and systematic methods, models and processes. In contrast the constructivist risk paradigm, as mentioned above, understands risks as pure constructs made by humans, and also non-humans, which only exists qua their construction as such by those actors. The constructivist risk paradigm thus extends the social constructivist risk paradigm by arguing that construction of risks also depends on non-human actors. These non-human actors are perhaps even co-constructed to facilitate the construction of risks and thus also serve as mediators in the perception of risk, much similar to what the socio-cultural settings do for the social constructivists. The constructivist risk paradigm differs even more from the functionalist risk paradigm, where 'risk management' and its organisation and implementation in the long term will be shaped by the 'situational imperative'. In contrast, constructivists understand practices of 'risk management' as the outcome of complex networks of relations that take different trajectories depending on the interactions taking place. Thus this paradigm bares

the strongest resemblance to the post-structuralist risk paradigm, where 'risk' and 'risk management' are also assumed to be constructs, with the major exception that the constructivist risk paradigm focuses on "micro-level" associations and not meso-level developments when it comes to explaining how risks and practices of risk management are constructed.

One of the larger management accounting studies in this paradigm was made by Miller, Kurunmäki and O'Leary, who examined the implications of accounting and hybrids for the management of risks (Miller et al., 2008). Miller et al. found: (1) that the existing literature had tended to neglect the 'hybrid practices, processes and expertise' through which uncertainties were actually managed; (2) that the management of organisations had begun to transform around notions of risk and risk management, but in ways that also neglected the wide range of uncertainties related to hybrid practices; and (3) that accounting practices were central to this situation, as these practices always attempted to make visible and calculable the hybrids that it encountered, while at the same time it became hybridised itself through encounters with other disciplines. In documenting this, Miller et al. drew on data from three sources: (1) two previous case studies; (2) an examination of the literature on hybrids through the last two decades in social sciences; and (3) earlier literature in especially accounting related to hybrids. They concluded by stating that they found it a matter of concern that when so much actual risk management took place outside formal practices, why did so little academic literature deal with this. They thus called for more research into *actual* practices of risk management.

Another study was made by Kalthoff (2005), who looked into the role of technical devices in framing the performance of economic calculations and risk manage-

ment. Kalthoff regarded activities of calculation as epistemic practices that question the routines of everyday life, but which themselves are routine practices performed by technical devices. In relation to risk management, calculation constitutes the object it calculates; it brings it into existence, frames and fixates it; reveals it as an object (Kalthoff, 2005, p. 73). Kalthoff also stressed that in addition to "calculating something", calculation had to be understood as "calculating *with* something". Kalthoff then applied the above understanding of calculation to two large international banks with integrated risk management practices (however providing only scarce details regarding data). He arrived at three core findings: (1) that banks constitute companies anew through the application of technical devices when making lending decisions, that is, banks convert potential clients' annual reports into their own format by applying computer programmes to calculate economic figures such as ratios (*calculating something)*; (2) that the products of technical devices, i.e. the now transformed annual reports, are used in risk negotiation processes between bank subsidiaries and headquarters (*calculating with something)*; and (3) that economic writing (such as output computerized statements) has performance consequences as symbolic machines.

Millo and MacKenzie continued the research into technical risk devices by examining the intertwined relationship between the emergence, ascendance and establishment of financial risk management techniques and financial derivatives markets (Millo & MacKenzie, 2009).[8] More specifically, they studied the growth of financial risk management applications that made use of the Black-Scholes-Merton option pricing model in the period between the late 1960s and the early 1990s. They found that understanding the success of this model had more to do with its communicative and organisational *usefulness* rather than the *accuracy* of

[8] Millo and MacKenzie refer to both Kalthoff, 2005, and Miller & O'Leary, 2007.

the results it produced (Millo & MacKenzie, 2009, p. 638). This model allowed clearer communication inside trading organisations, reduced the complexity of financial data, enabled more efficient decision-making, solved the operational challenge of the clearing house when calculating the level of risk-based deposits required of traders, and created consensus among market participants, such as trading firms, options clearing houses and the securities regulators, to the degree that the Securities Exchange Commission used it to legitimise its regulatory decisions. Millo and MacKenzie even showed how market participants continued to use this model after the market crash in October 1987, albeit knowing that the model was empirically inaccurate.

In a similar vein, Jordan, Jørgensen and Mitterhofer (2013) advanced our knowledge about technical risk devices in their study of the relationship between management control and risk management by investigating the role of risk maps in project management settings. Jordan et al. found that risk maps served as 'mediating instruments' that allowed the "distributed actors to adjudicate interests, build confidence in and associate with 'the project' and its progress over time" (Jordan et al., 2013, p. 158). This was in contrast to earlier studies that had shown that risk maps primarily had to do with increased attention being paid to early warning signals and the production of audit trails (e.g. Power, 2007). The concept of 'mediating instruments' was here coined by Miller and O'Leary (2007) to indicate the link between the concepts of accounting inscription, mediating machines and market devices. Jordan et al. describe how "mediating instruments "directs the attention to the ways in which particular inscriptions mediate the relations between distributed actors, distinct imperatives and domains within a socio-technic network" (Jordan et al., 2013, p. 159). Jordan et al. then attributed this finding to the different quali-

ties of risk maps, such as their figurative and diagrammatic outlook, commensuration, prospective and evaluative connotations, and flexible zones of normality.

Rocher (2011) found that the technical risk devices themselves rarely were well-defined objects that were accepted or rejected without alternatives. He argued that technical devices had to be understood not as "a simple act of application of predetermined functions and goals through neutral intermediaries", but rather as "a process" undergoing transformation when confronted with different actors' interests (Rocher, 2011, p. 76). In drawing on actor-network theory and Callon's four moments of translation (Callon, 1986), and on the basis of a single case study of the implementation of a technical risk device in a French local government, Rocher found that acceptance of the device depended upon a complex web of interrelations in which technique and actors were intertwined. He showed how the device contained meanings and utilities that were not initially considered by their designers and which were later highlighted by the actors using the device, who in this way "reinvented" the device. Rocher concluded by recommending that more research be conducted into "how translations continue to work once a management device is implemented in an organization" (Rocher, 2011, p. 78).

The above four management accounting literature studies have all looked into the enabling role of risk management devices and have shown that these are far from "neutral" or "objective" devices that people apply linearly and without problems. The studies have showed that risk management devices take on different trajectories during implementation, trajectories that to a wide extent depend on their (perceived) usefulness rather than their accuracy. In this respect, the literature has tended not to focus much on the limiting role of these devices, their constraining or restricting effects, if any, on risk management practice. Kalthoff showed that

risk calculations became the subject of negotiation between actors with different interests, as calculated figures created boundaries within which decisions were later made. In the same manner, Miller et al. showed that 'enterprise risk management' ignored the hybrid practices, processes and expertise left outside the boundaries of 'an enterprise', where much of the actual reduction of uncertainty took place; and Jordan et al. indicated that something was left outside risk maps as these shaped boundaries of risk management. None of these studies, however, followed which unexpected effects, like limiting or constraining the practice of risk management, these technical risk devices were capable of producing.

It appears that only one study has attempted to respond to this by looking into how practices of risk management (not its technologies) can lead to the generation of new uncertainties that would not have existed without risk management. Vinnari and Skærbæk (2014) looked into the implementation of risk management in a Finnish municipality and focused on the unexpected effects, or uncertainties, generated during its application. In doing this, they traced the developments of this practice of risk management over several years and through two major scandals, relying on an analysis of public and confidential documents and semi-structured interviews. They drew on actor-network theory, but used different concepts than did Rocher, namely the concepts of framing, overflowing and reframing. They found that (due to its framing) risk management, besides reducing uncertainty also created unexpected uncertainties (overflows) that would otherwise not have emerged, including: uncertainties related to legal aspects of risk management solutions, uncertainties related to the definition and operationalisation of risk management, and uncertainties related to the resources available for expanding risk management. They authors then tracked these developments and showed the dy-

namic development of risk management over time as well as the changing roles of those involved.

To sum up, the constructivist literature has contributed by showing the contingent nature of risk management going beyond the social-constructivist notion of "cultural, social and political environments" by describing actual practices of risk management. Combined with the assumption that non-human devices must also be included, this has allowed the literature from this risk paradigm to examine the role of technical devices in much more detail. The literature from this paradigm has further demonstrated that practices of risk management might themselves end up producing uncertainties, which of course challenges the core ontological assumption of 'risks' as objective facts that is held by the rationalist-cognitive and the functionalistic risk paradigms. To wrap up this subsection, the constructivist risk paradigm, like the social constructivist risk paradigm, has been criticised for not providing accounts that can be generalised across organisations, sectors and counties. In response, however, this literature has claimed that what these organisations, sectors and counties have lost in generalisability, they have gained in context-specific knowledge and levels of empirical details.

3.2. The literature's impact on mega-projects

Before I describe the tensions within current risk management literature and the relevance of engaging with these, before I describe what scholars have called the incompleteness of our current knowledge of 'risk' and 'risk management' and the inadequacy of the current theories to explain (all) empirical findings, I would like briefly to explain what impacts the current risk management literature has had on risk management in mega-projects. I find that it is important to mention this, first of all because this dissertation deals with contemporary methods of risk manage-

ment, which, as I will explain later, to a wide extent draws on resources from the rationalist-cognitive perspective's ontological and epistemological understanding of 'risk' and 'risk management', and secondly because this demonstrates how little research has actually been applied on the study of mega-projects from a management accounting perspective, and thus that there is ample opportunity to increase our knowledge of this.

The literature in the rationalist-cognitive perspective has been shown to have a significant effect on the development of (project) risk management standards (Power, 2004, 2007, Winch & Maytorena, 2011). This literature has shown that risk management standards assume 'risks' to be objective facts "out there", which can be identified, assessed and reduced by means of highly structured and rationalistic risk management processes. These processes are to be integrated across all other organisational processes, aligned with organisational objectives, and applied throughout the lifetime of the organisation. If the organisation does this properly, it makes sure that all risks are taken into account and that the organisation reaches its objectives. To do all of this also requires defining a 'risk appetite' or the value of risks that the organisation is willing to accept. This appetite serves as the threshold against which all subsequent planning, identification, assessment, reduction, monitoring, etc., are conducted in order to eventually evaluate whether the practice has been successful. In Power's own words, risk management operates like a thermostat: "which adjusts to changes in environment subject to pre-given target temperature" (Power, 2009, p. 849).

One strand of literature that has had an even more direct effect has been the literature on 'optimism bias', defined as unrealistic expectations about the future (Weinstein, 1980). This literature has affected approaches to project management

through the notion of the 'planning fallacy', i.e. the inability to predict accurate project completion times (Buehler et al., 2002). The literature has shown that planners tend to take on an "inside view", which means that they focus narrowly on the project at hand, the objectives of that project, the resources needed, the uncertainties that prevent the success of the project, and so on. This, however, leads to optimistic forecasting and consequently project cost overruns (Buehler et al., 2002). Lovallo and Kahneman (2003) have proposed that organisations supplement this method with a simple statistical analysis of analogous efforts completed in other similar projects. They call this an "outside view", or 'reference class forecasting', i.e. "an objective forecasting method that counteracts the personal and organizational sources of optimism" (Lovallo & Kahneman, 2003, p. 61). The method completely ignores the details of the project at hand, and it involves no attempt at forecasting the events that would influence the project's future course. Instead it examines the experience gained from a class of similar projects, lays out a rough distribution of outcomes for the reference class, and then positions the current project in that distribution.

The literature from the other perspectives seems not to have had an impact on practice. It might be argued that the functionalist research should have had an impact due to the amount of contingencies found, but at least with the Danish public sector this seems to have had no impact whatsoever. This is not to say that practitioners do not take into account elements such as project size, project objectives, etc., when implementing risk management, but this seems to take place more on grounds of common sense than by reference to academic literature. In addition, it tends to take place in parallel with government regulation, which does not either refer to academic literature in other areas than the rationalist-cognitive. In the US, for example, the American Planning Association has endorsed 'reference class

forecasting' and encouraged all planners to use this method to improve project viability (American Planning Association, 2005). In the UK, HM Treasury has recommended all British governmental departments to adjust project cost, benefit and duration estimations using 'reference class forecasting' (HM Treasury, 2003, 2004). In Denmark, the Ministry of Transport has similarly implemented a new budgeting method inspired by the ideas of 'reference class forecasting' (Transportministeriet, 2006), and the 'Swiss Association of Road and Transportation Experts', see Flyvbjerg (2009), as well as 'The Australian Road and State Traffic Authority', see Li et al. (2010) are involved with the same.

3.3. Implications, tensions and opportunities

Overall, the current risk management literature has advanced and expanded our knowledge about 'risk' as a phenomenon per se, and 'risk management' as a management control practice seen from different risk paradigms ranging from the rationalist-cognitive to the socio-cultural and constructivist paradigms. These paradigms have advanced our knowledge by each having its own key focus, which allows them to see things differently and thus supplement each other. The rationalist risk paradigm, for example, produced mathematical ways of modelling risks in order to allow calculations of the probability and impact of these across time, space and location. The cognitive risk paradigm continued along this line of thinking, but drew on various psychological methods to demonstrate that the human perception of risks is systematically biased and that different groups of people perceive risks systematically differently. The functional perspective took a different path and focused more on the practices of risk management and the various contextual factors that could determine differences between these practices, and subsequently how organisations should design them in order to optimise risk management effectiveness. In combination, these perspectives relied much on the

same strong realist approach to 'risk' and 'risk management' and thus supplemented each other well to further the development of for them more optimal and better risk models.

In contrast, the social constructivist risk paradigm broke with the idea of risks as being objective or neutral facts and regarded them as always being embedded within cultural, social and institutional systems/settings. The literature in this paradigm showed that the ways in which risks and practices of risk management were understood depended, for example, on top management predilection towards quantification and the boundary-work of risk experts. This literature also pointed to the strong influence of the accountancy profession by shaping the logic of best-practice approaches to risk management (logic of auditability). The structuralist risk paradigm maintained a similar understanding of 'risk', but focused on explaining this with reference to processes of modernisation, that is, it took a macro-level perspective. The literature in this paradigm further had a normative-critical agenda, as risks were perceived as something that posed a threat to humanity and thus had to be eliminated. In summary, these two risk paradigms took what can be called a weak constructivist or realist perspective to supplement the stronger realist approach of the rationalist-cognitive and the functionalist risk paradigms. They demonstrated the importance of taking into account the cultures, institutions and structures that surround the perceptions of risk and practices of risk management in order to fully understand them.

The last two risk paradigms, the post-structuralist and the constructivist, were both set apart by taking a strong constructivist approach to the understanding of risk. The post-structuralist risk paradigm pointed to the disciplining effects of risk management dispositifs or discourses and how these shaped the logics of practices of

risk management. This perspective focused on meso-level developments and thus supplemented the structuralist macro-level perspective and complemented the social constructivist perspective. In contrast, the constructivist perspective focused on actual interactions or associations taking place in for example organisations, and how risks were dealt with through these practices. This paradigm pointed to the enabling effects of technologies and the importance of understanding the construction of risks as part of larger networks of associations not limited to human beings. It further demonstrated that practices of risk management could themselves produce new uncertainties, and it thus pointed to potential complex relations between risk management and other practices. In combination, all of the above risk paradigms – from the rationalist-cognitive to the socio-cultural and the constructivist perspective – have advanced our knowledge in different ways.

Despite its interesting contributions, however, the above literature in these paradigms has not paid attention to all aspects of 'risk' and 'risk management' and must therefore be termed incomplete or inadequate to explain (all) empirical developments. As notions of 'risk' and 'risk management' have proliferated in recent years to the extent of transforming organisational management, this makes advancing our knowledge of this most relevant. If companies, for example, rely on practices of risk management and their embedded logics to improve management decision-making, knowing the effects of this seems relevant. In a similar vein, now that governments implement holistic risk management to curb cost overruns and ensure project success, knowing what risk management will imply seems relevant. This has also been recognised by prominent scholars, who are now calling for more research into especially organisational practices of risk management and the linkage to notions of 'corporate governance', 'management control' and broader notions of organisational management (e.g. Bhimani, 2009; Gephart et al.,

2009; Kaplan et al., 2009; Mikes, 2011; Miller et al., 2008; Power, 2009; Van der Stede, 2011; Young, 2011). In recent years, well-known journals have even published special issues on the subject, such as Organization Studies, Vol. 30, Issue 2-3, from 2009, and Management Accounting Research, Vol. 24, Issue 2, from 2013.

One of the major aspects listed as an area about which we lack knowledge is "the particularities of risk management characteristics in specific organizational settings" (Bhimani, 2009, p. 4). It follows from the above literature review that the current risk management literature has tended to disregard the mechanisms of risk management practices as they develop over longer periods of time. As Rocher (2011, p. 78) states: "It would be interesting in the future to study how translations continue to work once a management device is implemented in an organization". Or as Miller et al. (2008, p. 962) states: "But, if hybrids are where so much of the action is, and if so many social scientists from so many disciplines have emphasised their importance for two decades or more, why are they not given greater prominence in risk management?". Both of these two quotes illustrate the fact that researchers are calling for more research into what Bhimani termed "the particularities of risk management", that is, how risk management develops over longer periods of time. Vinnari and Skærbæk (2014) did follow one such practice over a longer period of time, but they stayed within the formal boundaries of 'a municipality' and did not follow the "the hybrid practices, processes and expertise".

In this sense, Vinnari and Skærbæk (2014) did the same as most other risk management scholars; they looked "behind the scenes of risk management to its actual *organizational* settings" (Mikes, 2009, p. 19, my emphasis). Arena et al. (2010), Mikes (2009, 2011) and most of the contingency-based studies did the same when they limited themselves a priori to examining the risk management practices of

fixed organisational entities such as financial or non-financial companies. In contrast, Hayne and Free (2014) followed Miller et al.'s (2008) notion of "hybrid practices, processes and expertise" and examined how COSO ERM proliferated through hybridised processes to ultimately become the worldwide "best-practice" risk management standard. Hayne and Free, however, pursued this at the institutional meso-level and did not engage with "the particularities of risk management" at the micro-level as recommended by Bhimani (2009). This means that despite the highly interesting nature of the above studies, we still know very little of how "micro-level practices" develop over longer periods of time or the translations they undergo (Rocher, 2011). Thus, the *first* subject that emerges as something future research could engage in is looking further into the particularities of specific practices of risk management going across organisational boundaries in order to understand the complex dynamics, or the trajectories, they take over longer periods of time.

The current literature across the different risk paradigms has further tended to disregard the examination of the ways in which risks are constructed first as specific "objects" and then as "risky" through networks of relations (Hilgartner, 1992). In general, this follows from the current literature's reliance on the philosophies of science that underpin the above perspectives. In the rationalist-cognitive risk paradigm, for example, risks have been perceived as objective facts "out there" and treated "as the independent variable and people's response to it as dependent" (Douglas, 1985, p. 25). This also follows from the psychometric studies mentioned above, where the relative influence of different cognitive factors have been mapped in relation to people's perception of different types of risks (Slovic, 1987). This has been critiqued by the social constructivist risk paradigm, as it leads to a one-sided analysis of 'risk' and 'risk management' that tends to neglect

the cultural, social and institutional settings. As Hilgartner points out, however, the social-constructivist risk paradigm is hit by the same critique as "their explanations often have a similar structure" (Hilgartner, 1992, p. 39). This also goes for the post-structuralists, who consider risks to be determined by "variables" such as dispositifs, discourses, power-relations, etc. The constructivist risk paradigm seems to be the only risk paradigm that allows for the understanding and examination of risks as the "dependent variable" (Hilgartner, 1992).

The literature in the constructivist paradigm, however, has not made the construction of "risk objects" subject to their inquiry – particularly not how these objects are made "risky" rather than "beneficial", or something else. This literature has mainly focused on describing the enabling role of technologies or technical risk devices and the various trajectories they take as they become useful to certain actors. In this sense, the current constructivist literature has tended to focus on demonstrating that models are neither accurate nor linearly applied to solve straightforward issues of identifying and managing the so-called risks "out there". A *second* future avenue for research thus relates to going into these "particularities of risk management" and examine (1) how "risk objects" are constructed, and (2) how such objects are translated over longer periods of time through hybrid networks of association. Doing this may advance our knowledge of whether all things are indeed translated into risks or whether some uncertainties are excluded from practices of risk management – and then what effects this generates for organisational management over longer periods of time. In the light of the current situation that 'risk identification' has become one of the key pillars of all types of risk management practices that are carried out on a regular basis by practitioners (e.g. Raz & Hillson, 2005; Winch, 2010) , it seems most relevant to inquire into this.

It also appears that very few studies investigate the distinction between the broader notion of 'uncertainty' as the potential infinite unknown and the narrower notion of 'risk' as uncertainty made calculable (Callon et al., 2009). This distinction was brought to attention by the economist Frank Knight, who argued that only risks could be subjected to calculation and quantification (Knight, 1921). In contrast, Knight argued that uncertainty referred to unmeasurable events arising from "the impossibility of exhaustive classification of states" (Langlois & Cosgel, 1993, p. 459). The literature has mainly focused on showing that standards / frameworks tend to ignore this distinction (e.g. Froud, 2003; Winch & Maytorena, 2011) or that "uncertainty/risk reduction" per se can lead to unwanted consequences, like loss of project relevance (Kreiner, 1995), lack of broader value-orientation (Morris, 2010), or a false sense of control (Weick & Sutcliffe, 2001). It has also been suggested that uncertainty management might be better than risk management (Chapman & Ward, 2011), and that uncertainties are dealt with outside of formal risk management practices (Corvellec, 2009; Miller et al., 2008). Thus, it seems that there is a lack of research into (1) how uncertainties are translated into objects, (2) how objects are distributed according to their "risky" characteristics, (3) what the effects of these processes are, and (4) the dynamics of this over a longer period of time.

It would be relevant to look into the relationship between uncertainties and risks, because when frameworks understand both as "calculable entities", as prior research has shown, then practices of risk management "risks" that people become overconfident. If people believe that the practices of risk management have taken all uncertainties into account, they have little reason to stop up to consider risks before making their decisions. This can lead to even further negative consequences, such as people becoming frustrated, angry and/or pessimistic. If events happen

that people thought had been handled by the practice, but now realise they had not, due to the limited focus on "calculable entities", they might turn risk averse and lose faith in the practice altogether. This may lead them to become ineffective and afraid of making decisions of which the outcome is unknown. This is of course all speculation, but that is why it would be relevant to examine the relationship between uncertainty and risk within actual practices of risk management and track it over time. This might reveal unexpected effects that have not yet been considered by either the current literature or practitioners working with this area, which in turn might advance our understanding of risk management and its effects.

In this respect, the current risk management literature has also tended to ignore the more limiting or constraining effects that non-human actors such as technologies or technical risk devices may have on risk management practices. This is despite the situation that contributions to the literature in the social constructivist risk paradigm (e.g. Arena et al., 2010; Mikes, 2009, 2011) and the contingency-based functionalist risk paradigm (e.g. Beasley et al., 2005; Collier & Woods, 2011; Gordon et al., 2009; Kleffner et al., 2003; Liebenberg & Hoyt, 2003; Paape & Speklé, 2012) have demonstrated the importance of taking non-human actors into account. This literature, however, has tended to focus on technical risk devices as passive devices that "simply" improve human possibilities of carrying out more effective risk management. In an extension of this, the literature in the constructivist risk paradigm (e.g. Jordan et al., 2013; Kalthoff, 2005; Millo & MacKenzie, 2009) has demonstrated that technical risk devices also become more active mediators in the practice of risk management. Except for Vinnari and Skærbæk (2014), however, this literature has tended to neglect the "unexpected effects" that these non-human actors can produce, in spite of the situation that this has been shown elsewhere in the accounting literature to be important (e.g. Chua, 1995; Qu &

Cooper, 2011; Quattrone, 2009; Quattrone & Hopper, 2006; Robson, 1992; Skærbæk & Tryggestad, 2010).[9]

The above-mentioned missing focus on the potential constraining effects of risk management devices thus opens up a *third* element that we lack knowledge about and which future research could engage in, namely the more detailed effects of devices. To list only a few of the more common risk management techniques that future studies could focus on: "risk premium calculation, risk adjusted discount rate, subjective probability, decision analysis, sensitivity analysis, Monte Carlo simulation and stochastic dominance" (See Akintoye & MacLeod, 1997, p. 36); or the perhaps most commonly used technique these years: the traffic light assessment matrix, or risk maps (See Jordan et al., 2013; Power, 2007). As stated by Winch (2010, p. 347) in the Oxford Handbook of Project Management: "[technology] lies at the heart of the [risk management] process which is used to assign responsibility and accountability for risks, monitor their status and prioritize action". On this background, examining the role of non-human actors and their potential constraining effects on the identification, assessment, reduction and monitoring of risks thus seems most relevant. This has also more explicitly been called for by scholars within constructivist research (e.g. Vinnari & Skærbæk, 2014).

The *fourth* and last avenue for future research I would like to mention refers to the situation that the current literature has largely not dealt with the notions of 'risk' and 'risk management' in large capital investment programmes, or mega-projects. This seems unfortunate, as present-day governments to an increasing extent rely on comprehensive practices of risk management to ensure that projects are viable.

[9] See Section 4.2 for a more detailed description of "classic" actor-network theory studies in the accounting literature, and Section 6.3 for a brief description of papers looking into the effects of technical devices.

As shown in the previous subsection, the literature that has primarily dealt with the notions of 'risk' and 'risk management' in mega-projects has been written by scholars taking the rationalist-cognitive perspective. They have focused on notions such as 'optimism bias' and 'strategic misrepresentation' in order to demonstrate that we need to take an "outside view" to counteract "personal and organizational sources of optimism" (Lovallo & Kahneman, 2003, p. 61, but see also Flyvbjerg, 2006, 2008). This includes implementing practices of risk management as institutional check-and-balances to improve accountability and transparency and reduce incentives to manipulate project forecasts (Flyvbjerg, 2006, 2011). The literature in the rationalist-cognitive perspective, however, has not focused on the empirical effects generated by practices of risk management. It builds on psychological experiments and statistical project budget vs. total cost comparisons and thus downplays the insights provided by the constructivist perspective that *processes* cannot be neglected. This means that we know little about what happens between the points when forecasts have been made and projects are handed over.

It also means that present-day governments are imposing risk management as a management control practice on public agencies or state-owned enterprises without knowing much about the effects it has on actual project processes and subsequently project viability. If we further take into account that millions of euros go into the implementation and operation of such practices, this just adds to the relevance of looking into this. In this sense, mega-projects are high-risk projects that are highly exposed to the so-called 'black swans', those high-impact, hard-to-predict and rare events that lie beyond the realm of normal expectation (Taleb, 2007). This seems to suggest that practices of risk management will be inaccurate or incomplete, something which Millo and MacKenzie (2009) demonstrated, but where does this leave us? If practices of risk management are to produce certainty

regarding events with potentially negative effects on project objectives, can they do so? "If accuracy includes a fundamental practice-dependent dimension, then can the usefulness of a practice become a substitute for its lack of accuracy?" (Millo & MacKenzie, 2009, p. 652). These questions are difficult to answer, but to make an attempt to do so requires at least going into practice and examine this.

In summing up this section, it seems that our knowledge of the actual mechanisms of risk management is incomplete and that "the potential of these theories to inform studies of risk and organization has not been fully developed or realized" (Gephart et al., 2009, p. 142). In relation to mega-projects, it even seems as if theories have informed governments to implement risk management on "weak theoretical grounds" (Flyvbjerg, 2011, p. 340). In the three research papers included in this dissertation I will deal with the current academic literature on 'risk' and 'risk management' and attempt to advance our knowledge of these concepts. In short, I will look into: (1) the construction of risk objects including the relationship between uncertainties and risks and the effects of technical risk devices (both enabling *and* constraining), (2) the relationship between theories (or more specific, frameworks) and practices of risk management, and (3) the effects of risk management on conditions of knowledge and project objectives. I will look into this over longer periods of time and on mega-projects, thus continuing the constructivist tradition of going into the details of everyday practices to the "hybrid practices, processes and expertise" through which all of this takes place. I hope that by looking into these subjects, and doing so in relation to (public) mega-projects, I will be able to advance our knowledge of 'risk' and 'risk management'.

4. Theoretical framework

This section introduces the theoretical framework applied in this dissertation, actor-network theory, by elaborating on its basic concepts and underlying philosophical assumptions. This section does not go into details of the more specific concepts that I rely upon in the three research papers; these concepts are introduced in the papers. In this section, I also explain what relying on actor-network theory has meant for the way I perceive 'risk' and 'risk management', and I describe how other management accounting studies have drawn upon actor-network theory and what contributions this has led to. I need to stress up front that actor-network theory breaks with the conventional idea of a distinction between epistemology and ontology; it even breaks with the "classic" purpose of a theory: to explain something. It is neither radical nor reductionist or deconstructivist, however, but rather relationalist and constructivist in its philosophical underpinnings.

4.1. Actor-network theory and its basic concepts

> *"I will start by saying that there are four things that do not work with actor-network theory; the word actor, the word network, the word theory and the hyphen! Four nails in the coffin".*
>
> *– Bruno Latour (1999a, p. 15)*

If there is one thing that has always been true about actor-network theory, it is that actor-network theorists have always been ambivalent towards the task of defining its core concepts or the elements that constitute its very "essence". These have been debated on several occasions when actor-network theorists, as demonstrated above, have insisted on not defining its core concepts and rather let this lack of

definition be its definition. In 2005, however, Bruno Latour realised that despite everything that may have been wrong with its name, that name had been adopted by people, and therefore had to have some value after all: "I have to apologize for taking the exact opposite position here as the one taken in Bruno Latour (1999[a, see the above quote]). Whereas at the time I criticized all the elements of this horrendous expression including the hyphen, I will now defend them all, including the hyphen" (Latour, 2005, p. 9, note 9). Why, then, do I insist on defining actor-network theory when there seems to be so much ambivalence towards it? Well, because how else could I stay true to actor-network theory without starting out being ambivalent towards the objective I seek to pursue! And to make things worse, I will begin with exactly what Latour wrote was wrong, but now right, with actor-network theory; I will begin by defining "the word actor, the word network, the word theory and the hyphen!"

4.1.1. "The word actor"

> *"An "actor" in ANT is a semiotic definition – an actant –, that is something that acts or to which activity is granted by others. It implies **no** special motivation of **human individual** actors, nor of humans in general. An actant can literally be anything provided it is granted to be the source of an action". (Latour, 1996, p. 373)*

The most fundamental concept in actor-network theory is the word/concept 'actor'. In actor-network theory the concept of actor refers to "the moving target of a vast array of entities swarming toward it" (Latour, 2005, p. 46). It refers to *something* that acts and therefore implies no special motivation of human actors, but allows plants as well as rocks and tools and devices to be actors; they just have to be

"granted to be the source of an action". This means that actors take their form and acquire their attributes as a result of their relations with other entities; actors "have no inherent qualities", they have no essence (Law, 1999, p. 3). This does not mean that actors are *determined* by other actors or that objects act on their own; hammers do not require you to hit the nail; the television does not require that you watch it, and so on. Actor-network theory means that it matters whether you hit the nail with or without the hammer; it means "*any thing* that does modify a state of affairs by making a difference is an actor" (Latour, 2005, p. 71). In relation to risk management, actor-network theorists would argue that it makes a difference whether you describe objects as risky with or without the use of risk identification tools or assess them with or without calculation techniques. Plainly and simply put: "If an actor makes no difference, it's not actor" (Latour, 2005, p. 130).

Latour has argued that actor-network theory originated from three studies: Michel Callon's "Some elements of a sociology of translation: domestication of the scallops and the fishermen of St. Brieuc Bay" (Callon, 1986), John Laws' "On the Methods of Long-Distance Control: Vessels, Navigation and the Portuguese Route to India" (Law, 1986), and Latour's "The Pasteurization of France" (Latour, 1988), cf. Latour (2005, p. 10). These three studies were all characterised by describing exactly how different actors granted other actors – human as well as non-human – to be the source of an action. Callon (1986), for example, showed that *scallops* had to be interested, enrolled and mobilised, just like human actors such as fishermen and other scientists, for three scientists to complete their research programme. The three researchers had to convince the scallops to continue existence in new waters where parasites, varying temperatures, currents and predators threatened their success. Similarly, the three researchers had to convince the fishermen not to catch the scallops, and the rest of the research community that their

ideas, methods, etc., were sound. In the end, the scientists managed to mobilise the scallops and provide evidence for their findings to satisfy the scientists, but eventually the fishermen betrayed them all and harvested the scallops for money.

One of the consequences of perceiving actors as sources of other actors' actions is that actors turn into flows; they become circulating entities with distributed characteristics that vary over time, space and location depending on the relation to those other actors (Latour, 1996). This means that actors will always be subject to negotiation and trials-and-error between other actors with different interests. Another consequence is that because actors are assumed to be the (temporary) outcome of a long struggle, they cannot a priori be divided into large or small actors, or into macro and micro actors (Callon & Latour, 1981, p. 280). This is not to say that these categories do not exist; actor-network theorists do not deny that some actors are stronger, bigger or more superior than others, but only that this relies on examinations of relations. A third consequence is that human identities cannot be understood as something that can be determined by actors through intellectual application alone; "nor are they the result of values, norms or institutions which reduce actors to the status of the 'cultural dope' so justifiably ridiculed by Garfinkel" (Callon, 1998a, p. 252). The actor's identity is variable: "his or her objectives, interests, will and thus identity are caught up in a process of continual reconfiguration" (Callon, 1998a, p. 253).

Latour also distinguished between two types of actors: intermediaries and mediators. He defined the first type as those which "transport meaning or force without transformation" (Latour, 2005, p. 39). He compared intermediaries to 'black boxes', which he together with Callon elsewhere defined as "that which no longer needs to be reconsidered, those things whose contents have become a matter of in-

difference" (Callon & Latour, 1981, p. 285). Based on my observations, in relation to risk management this could for example be the control system used to register identified risks and track their status over time. In normal circumstances, this control system would not be questioned but rather assumed to provide the output risk information corresponding to the earlier input risk information. In contrast, Latour defined mediators as those which "transform, translate, distort, and modify the meaning or the elements they are supposed to carry" (Latour, 2005, p. 35). In continuation of the above example, if the system for some reason broke down, resulting in data loss, this would cause managers not to know the status of their risks and thus potentially mean that some risks were not managed. In this case, the control system had turned into a mediator actively distorting the information it was supposed to carry.

In writing texts, such as research papers or dissertations, Latour has further stressed that "good" texts are those that describe a string of actions where each participant is treated as a full-blown mediator. He writes: "To put it very simply: A good ANT account is a narrative or a description or a proposition where all the actors do something and don't just sit there. Instead of simply transporting effects without transforming them, each of the points in the text may become a bifurcation, an event, or the origin of a new translation. As soon as actors are treated not as intermediaries but as mediators, they render the movement of the social visible to the reader" (Latour, 2005, p. 128). In contrast, "bad" texts are those that only designate a handful of actors as the causes of others, "which will have no other function than to serve as a backdrop or relay for the flows of causal efficacy." (Latour, 2005, p. 130). It is the type of account that waters down translation into transportation, into displacement, without transformation. It simply transports causality through mere intermediaries. In this sense, with arguments such as media-

tors "render the movement visible to the reader", actor-network theory has methodical implications for what and how to collect data. I will not go further into detail here, however, as the next section looks into this in much more detail (see Section 5).

4.1.2. "The word network"

The second word/concept 'network' is closely entangled with the term 'actor'. In actor-network theory, the word 'network' refers to filaments or fibrous, thread-like, wiry, stringy, ropy and capillary associations drawn between entities. It does not refer to the common-sense understanding of networks as *pre-fixed* entities such as computer networks, sewer systems, or exclusive groups of people (Latour, 2005). It would be a common mistake, Latour (1996) argues, to ascribe such a fixed and stable meaning to networks. 'Network' is a concept used to describe something; not a thing out there that needs to be described (Latour, 2005, p. 131). Actor-network theory thus reverses the "classic" understanding of the concept. It does not start from universal laws and regard contingencies as deviations or particularities that should be either eliminated or protected (or, in relation to risk management, identified in order to optimise its function); it starts from "irreducible, incommensurable and unconnected localities", which then "sometimes end into provisionally commensurable connections", a *process* we call a network (Latour, 1996, p. 370). In this way, 'networks' have a fundamental, philosophical importance:

> *"Literally there is nothing but networks, there is nothing in between them, or, to use a metaphor from the history of physics, there is no aether in which the networks should be immersed". (Latour, 1996, p. 370)*

It follows that actor-network theorists perceive networks as both the "how" to perceive the world and the "being" of the world; "there is no aether in which networks should be immersed"; there are nothing except networks. This dissolves the traditional dichotomy between ontology (being) and epistemology (perception); we bring the world into "existence" through our perception/understanding of that world. This further means that you would never be able to go out and point to a network; networks have no material essence or existence per se; they are brought into existence through the associating work of actors. In addition, these networks are not relativistic, but relational, meaning that they could be different, and most often are, but they are never random, or just so (Law, 1999, p. 6ff). This also means that *one* network never exists; no one reality exists; there are always more realities, more networks; networks are multiple, located, performed and enacted, i.e. ontolog*ies* are made (Mol, 1999). There are always multiple, co-existing "possible states of the world" (Callon, 1998b, p. 4). This also means that actor-network theory breaks with the "classic" understanding of 'risks' as ontological facts or truths "out there"; risks are constructs, performed associations (Latour, 1986).

The reason why I stated that the word 'actor' was related to the word 'network' is that actors are those that give meaning to the abstract notion of networks through their associating work (which brings other actors into existence). "There is not a net and an actor laying down the net, but there is an actor whose definition of the world outlines, traces, delineates, describes, files, lists, records, marks, or tags a trajectory that is called a network" (Latour, 1996, p. 378). The words 'actor' and 'network' are therefore "two sides of the same coin" and may best be grasped through the term 'actor-network' (Callon, 1998b, p. 8). These actor-networks further need to be stabilised (framed) to enable predictive and effective interaction

between actors (Callon, 1998a). If not, there would be no common language, no societies, no markets, no families, etc., there would be only disorder (overflows). This does not mean that actor-networks can be "finalised" somehow; actor-networks are always open for negotiation, always fluid and changing, never stabilised "for good". In relation to risk management in mega-projects, for example, project managers are responsible for carrying out risk management as part of their work descriptions. This has been written down in their employment contracts. In principle, however, just because the project managers have bound themselves to a contract, this does not necessarily mean that they always follow it; they can always choose to act differently and thus "betray" their commitment to it and the actor-network.

The notion of network breaks with different dichotomies. Firstly, it breaks with the difference between far/close, the notion of distance. Just because two elements have a close, geographical proximity, this does not mean that they are closely connected; and conversely, just because two elements are far apart, this does not mean that they are distantly connected. In the Signalling Programme, for example, the European Parliament can be infinitely closer than the Danish Traffic Authorities, because European regulations may have a stronger impact than local Danish legislation does. Secondly, it breaks with the difference between small scale and large scale. This distinction seems to denote that some actors are ranked higher, or are bigger, like "macro" institutions or society, compared to lower ranked "micro" family relations. The notion of 'network' allows us to dissolve both of the above distinctions by focusing on connections or associations instead. These imply no a priori hierarchical order of relations. In actor-network theory, one network is never bigger than another one; it is longer and more intensely connected. Instead of opposing the individual level to the mass, or agency to structure, in actor-network

theory the focus is on tracking how a given element becomes strategic, or "important", through the number of associations it commands (Latour, 1996, p. 372).

Thirdly, actor-network theory breaks with the distinction between inside/outside. This distinction is often related to notions of 'space', 'layers', 'surfaces' or 'territories', which always assume that there is something in between and thus that boundaries would have to be established to delimit these notions. In actor-network theory, there is nothing in between networks; there are only actors laying out nets, associating elements with other elements; only networks that are either *expanding* or not. This does not mean that actor-network theory does not include boundaries; 'networks' are all about boundaries. The only question that needs to be asked, however, is whether a connection has been established or not (and who made it, and how etc.). This is a great force of actor-network theory. It means that it is possible to focus on tracking the actual associations made, irrespective of organisational boundaries, geographical territories, space, layers, hierarchies etc. If anything, these are *effects* of the associating work of actors; effects that can be captured with the notion of actor-networks.

4.1.3. "The word theory"

The previous two subsections have brought us back to the starting point: "If [actor-network theory] is a theory, of what it is a theory?" (Latour, 1999a, p. 19). In reply to this question, actor-network theory is a theory about "what the recording device should be that would allow entities in all their details to be described" (Latour, 1996, p. 374). It focuses on the *recording* of things, the description of processes, and not on the specific outcome of the recording, the potential things "hidden" behind what was recorded that needs explanation. In consistency with the previous two subsections: "actors know what they know and we have to learn

from them not only what they do, but how and why they do it" (Latour, 1999a, p. 19). If we focus on the collective, stabilised network and attempt to explain it, we will limit the role of actors to that of informers offering cases of well-known outcomes: "You have to grant them back the ability to make up their own theories… Your task is no longer to impose some order, to limit the range of acceptable entities, to teach actors what they are, or to add reflexivity to their blind practice. Using a slogan from ANT, you have 'to follow the actors themselves'" (Latour, 2005, p. 12).

Actor-network theory thus insists on the absolute freedom and infinite pliability of the actors and does not impose on them an a priori definition of their capacities. It does not become an empiricist account, though. It is not about providing mere descriptions of relations that otherwise require explanation. Actor-network theory makes a strong theoretical commitment to the relational or political ontology of networks and thus how the world is brought into existence through the actors' description of it (Latour, 1996). This means that the descriptions provided by the actors, which the researcher tracks, are all the explanation required:

> *"The very divide between description and explanation, hows and whys, blind empiricism and high theorizing is as meaningless for ANT as the difference between gravitation and space in relativity theory. Each network, by growing, "binds" the explanatory resources around it, and there is no way they can be detached from its growth. One does not jump outside a network to add an explanation – a cause, a factor, a set of factors, a series of co-occurrences; one simply extends the network further". (Latour, 1996, p. 376)*

Actor-network theory is also not reductionist or deconstructive. “Nothing can be reduced to anything else, nothing can be deduced from anything else, everything may be allied to everything else” (Latour, 1988, p. 158). Actor-network theory does not seek to discover the new “big bang” of the universe from which to deduce its evolution, a new Archimedean point, nor does it attempt to deconstruct networks into mere associations: quite the contrary. In actor-network theory, attempts are made at understanding the development of heterogeneous networks and the effects they produce, such as certainty, agreement and stabilisation, but also uncertainty, disagreement and destabilisation, or better, movements between these. In actor-network theory, a text, a description, an account, a dissertation adds to the network it describes; it does not subtract something from it; it does not deconstruct the network as if the produced account stood above or outside the network looking down on it. In studying risk management, actor-network theory is thus a theory to capture the developments over time of practicing this; the processes not the result; the construct*ion* of risks, not risks construct*ed*.

4.1.4. “And the hyphen!”

The last word I want to describe is the “hyphen”, the “-“ between the word ‘actor’ and the word ‘network’ in “actor-network”. The hyphen sheds light on the importance of connections, associations, relations or interrelations. In capturing these by just one word, actor-network theorists have used the broad notion of ‘translation’. This word denotes the active process of both “transformation/displacement” and “transportation” in which stabilised associations represent rare and always temporary achievements (Callon, 1986). It also indicates that association is not just some random, or worse, passive process, which would correspond to transportation without transformation. This would be the risk management control system described above, before it crashed and simply transported input information from

one meeting into a risk report that could be read at a later point in time. In contrast, translation refers to the work of mediators, like the control system after it crashed, which suddenly made it difficult to carry out risk-reducing actions because the information provided had been distorted. In defining translation more specifically, Callon and Latour state as follows:

> *"By translation we understand all the negotiations, intrigues, calculations, acts of persuasion and violence, thanks to which an actor or force takes, or causes to be conferred on itself, authority to speak or act on behalf of another actor or force". (Callon & Latour, 1981, p. 279)*

The concept of translation thus implies that associations are always mediating; it is associations that induce two mediators into co-existence (Latour, 2005, p. 108). These associations always develop non-linearly and dynamically, and never rationalistically or causally determinable. The only associations that would transport causality would be those consisting of a series of intermediaries that would simply transport without transformation; they would represent black-boxed relations. In contrast, translation is the process of: "… displacement, drift, invention, mediation, the creation of a link that did not exist before and that to some degree modifies the original two" (Latour, 1999b, p. 179). It is through translation that certain actors expand the network and entangle with other actors; it is through translation that effectiveness, predictability and stability can be achieved; it is through translation that trials-of-strength take their trajectories; and it is through translation that "good" texts are produced. In relation to risk management, studying this as a phenomenon would therefore mean tracking the series of translations that take place in relation to events such as: the construction of uncertainties as risks, the inven-

tion of technical risk devices and their application, the distribution of risk roles and identities, the relationship between frameworks and practices of risk management, the negotiations taking place in the practising of risk management, the relationship between risk management and project conditions, the effects produced by risk management, and more.

In "Pandora's Hope", Latour (1999b) illustrates what he means by translation by refuting two typical statements: "Guns kill people" and "People kill people; not guns". The first, he argues, is a materialistic claim: the guns acts by virtue of material components irreducible to the specific person firing the gun. The second is a social constructivist claim: the gun is a tool, a medium, "a neutral carrier of will" (Latour, 1999b, p. 177). If the person firing the gun is good, he will use it wisely, for example, for self-defence; in contrast, if the person is bad, the person will use it, for example, for murder. What does the gun add to the shooting? Latour argues that to the materialist: everything. The gun is what makes the person a criminal. In contrast, to the social constructivist, the gun adds nothing to the action; the action was carried out by a person, the gun being only the medium which adds neither "goodness" nor "badness" to the person firing it. Latour, however, refutes both accounts. To the materialists, he argues that the gun on its own cannot kill anyone, and to claim so would be to say that people's personalities are determined by whatever they hold in their hands; and to the social constructivists, he says that to claim that the gun merely transports the will of the person would be to claim that we are already from birth determined as being either good or bad (Latour, 1999b, p. 177).

Latour then presents his own account of the two statements. "Who, then, is the actor in my vignette? *Someone else* (a citizen-gun, a gun-citizen)" (Latour, 1999b, p.

179). He explains that people are different individuals with or without the gun in their hand: "I define you by whatever you have (the gun), and by the series of associations that you enter into when you use what you have (when you fire the gun), then you are modified by the gun – more so or less or, depending on the weight of the other associations that you carry. This translation is wholly symmetrical. You are different with a gun in hand; the gun is different with you holding it. You are another subject because you hold the gun; the gun is another object because it has entered into a relationship with you." (Latour, 1999b, p. 179). Latour continues and argues that the gun is now something else from the gun-in-the-armoury or gun-in-the-drawer, but through a series of translations (someone picked it up), it has now turned into a gun-in-the-hand. "The twin mistake made by the materialists and the social constructivists is to start with essences, those of subject or those of objects… It is neither people nor guns that kill" (Latour, 1999b, p. 180). Responsibility for action must be distributed across networks of relations.

The following subsection looks into how different accounting studies have applied actor-network theory and the contributions made. These all build on those four basic concepts outlined in this section: "the word actor, the word network, the word theory and the hyphen!", but supplements them with more specific and advanced actor-network theory concepts.

4.2. The application of actor-network theory in accounting literature

This subsection provides an overview of the major studies in the accounting literature that take on an either pure actor-network theory perspective or combine it with other theoretical perspectives, as well as the contributions made by these studies. The purpose of this section is to demonstrate the wide applicability of actor-network theory and the range of contributions made, and not to thoroughly

cover all actor-network theory studies in the accounting literature. See Justesen and Mouritsen (2011) for a more elaborate account of actor-network theory inspired accounting studies throughout the years. Justesen and Mouritsen cover the wide range of Latourian-inspired accounting papers and the yet unexplored potentials of Latourian actor-network theory to advance our knowledge. As Justesen and Mouritsen "only" cover Latourian approaches, however, see also Skærbæk (2009) and MacKenzie (2006) for two key papers that have drawn on Michel Callon's work and advanced our knowledge through this. In the following, I will not distinguish between those two approaches. Instead, I seek to give a broad introduction to the key contributions to the accounting literature made by scholars who draw on actor-network theory as a whole. I end this subsection by presenting a relatively unexplored application of actor-network theory in the accounting research, which might be drawn on to advance accounting research. I apply this approach to my three research papers.

The first few references to actor-network theory began to appear in the accounting literature in the late 1980s (Hines, 1988; Pinch et al., 1989), but the major studies that manifested actor-network theory's position were not published until the early 1990s (Miller, 1990, 1991; Preston et al., 1992; Robson, 1991, 1992). Miller (1990) examined the interrelations between accounting and the state, drawing upon the Foucauldian understanding of "rationales, programmes, values and ideals" and combining this with a Latourian understanding of the transformative effects of "devices and technologies" (Miller, 1990, p. 333). Miller showed that rather than being distinct essentialist entities, both "accounting" and "the state" were the effects of contingent historical processes. He went on to show that technologies mediated between the general and abstract level of political rationales and ideals and the immediate context of local accounting practices. Through 'inscription', these

technologies made it possible to translate rationales of government into local practices by allowing 'action-at-a-distance', the two concepts involved referring to the actor-network theory concept (See Latour, 1987). He also showed, reciprocally, that political rationalities accorded significance and meaning to quite mundane calculative accounting routines, "allowing practitioners to articulate their potential contributions far beyond their individual organizational practice" (Miller, 1990, p. 334).

In contrast to the above examination of accounting as phenomenon, Miller (1991) later went into the detail by examining one specific accounting innovation: the discounted cash flow technique. By again using the Latourian concepts of 'translation' and 'action-at-a-distance' and the Foucauldian concept of 'programmes', but this time also the Latourian concept of 'problematization', Miller found that the discounted cash flow technique made it possible for governments to 'act-at-a-distance' on the economy without intruding into the private sphere of managerial decisions. He showed that concerns about investment decisions in firms were problematised and constructed as concerns for overall economic growth. He then showed how translatability was established between political programmes aimed at improving this growth and the discounted cash flow technique used for individual investment decisions. In both of these studies, however, Miller (1990, 1991) was concerned with particular accounting innovations or changes and did not generalise upon his findings, and therefore he also recommended that more similar studies be conducted, going "beyond the enterprise" (Miller, 1991, p. 757).

Robson (1992) was one of the scholars who rose to this challenge. Robson looked into accounting numbers as 'inscriptions', like Miller (1990, 1991) drawing on Latour's understanding of this concept (Latour, 1987). Robson defined inscription

in relation to accounting as: "the material and graphical representations that constitute the accounting report: writing, numbers, lists, tables" (Robson, 1992, p. 685). Robson found that rather than being privileged representations that corresponded to reality, accounting numbers were inscriptions that enabled certain kinds of action, including 'action-at-a-distance', or long-distance control. He further found that accounting inscriptions displayed a strong mixture of mobile, stable and combinable qualities. Numbers inscribed buildings, people, products, etc., into numerical quantities that were transportable across entities, practices, and contexts; numbers are "powerful explanations" that can be modelled as needed (Robson, 1992). In this sense, Robson applied the theoretical framework for studying accounting change that he had embarked on with his publication the year before (Robson, 1991). Robson (1991) suggested that accounting change had to be studied as a 'process of translation', which he defined as "the process through which particular accounting statements, calculations and techniques are subject to a translation into wider social, economic and political discourses" (1991, p. 566).

In contrast to Miller's and Robson's studies above, which mainly drew on the notions of 'inscription', 'action-at-a-distance', and 'calculation', Preston, Cooper and Coombs (1992) drew upon the notions of 'black-box', 'fabrication' and 'network'. Preston et al. examined a budgeting system in the British National Health Service during the processes of 'fabricating' this and thus before it was established as a "finalised" system. In this sense, Preston et al. adhered to Latour's methodological recommendation of studying things "in action", which was in contrast to Miller's (1990, 1991) more Foucauldian-inspired genealogy approach.[10] In more detail, Preston et al. examined how debates about the conditions faced by the British Na-

[10] This dissertation also insists on adhering to this methodological point. The following section on method will explain in more detail what studying things "in action" means (see Section 5).

tional Health Service, about the levels of funding, modes of management, responsibilities of doctors and administrators, were translated into an initiative to develop a budgeting system. Preston et al. showed how fabricating this system was a fragile and uncertain activity and that encountered resistance ended up shaping the system. Fabricating the budgeting system was therefore an on-going translation process that took place in networks of relations, networks which themselves were under translation. Their study contributed by pointing out the non-linear processes through which accounting systems were developed and all the work taking place before the system eventually ended up being 'black-boxed' and apparently stable.

The above-mentioned studies from the early 1990s were supplemented by other key studies during the following years. In contrast to Miller's (1990, 1991) and Robson's (1991) focus on "programmatic" discourses, these studies, however, were characterised by looking into "micro"-level interaction and by explaining accounting change through that. One such key study was the one made by Chua (1995), who examined three Australian hospitals while drawing on notions of 'experts', 'networks', 'inscription' and 'fabrication' from actor-network theory. She showed how accounting figures were fabricated by a network of enrolled "fact builders" (academics, hospital personnel, government officials and Commonwealth bureaucrats) and software; these actors produced the "economic reality" that accounting was supposed to depict. She further showed how expert-generated inscriptions created faith in and generated credibility to the produced accounting figures and helped persuade actors to "content themselves" with these numbers and the produced reality. Along the same line of inquiry, Mouritsen (1999) showed how two different management control forms dominated strategic options as they each attempted to control organisational space differently. He showed how "questions of technologies could not be separated from questions of governance,

the boundaries of the firm and the status of the customer"; i.e. that management control forms fixated specific "realit*ies*" (Mouritsen, 1999, p. 53).

Briers and Chua (2001) represents another "micro"-level interaction-oriented paper. Briers and Chua looked into an aluminium construction company's implementation of an activity-based costing system. They drew on basic actor-network theory concepts and combined them with Star and Griesemer's notion of boundary objects as "…objects which are both plastic enough to adapt to several local needs and the constraints of several parties employing them, yet robust enough to maintain a common identity across sites" (1989, p. 393). They showed how networks of heterogeneous machines, 'boundary objects', local actors and cosmopolitans could change an organisation's accounting and productive capabilities. They also showed that understanding activity-based costing as a boundary-object could explain how diverse interests could be stabilised across local *and global* contexts. Jones and Dugdale (2002) continued the inquiry into activity-based costing, but argued that rather than being studied "in action", activity-based costing had to be studied as a phenomenon. Through studying it over the last decades they found that activity-based costing could not be attributed to a single author, but that it had turned into an effect of a contingent series of translations taking place between computer systems, consultancies, academics and the "global change in production and markets" (Jones & Dugdale, 2002, pp. 157-158). In concluding the latter, they further drew upon the work of Giddens and found that activity-based costing had turned into a disembedded expert system, albeit one that was formed mutually with the construction of the actor-networks that created it.

Another key study was made by Gendron, Cooper and Townley (2007), who looked into how the Office of the Auditor General of Alberta (Canada) acquired

the expertise to measure government performance in the light of new public management reforms. They drew upon "three features of fact building, namely, laboratories, networks and the observation that the fate of a factual claim rests in its reception by others" (Gendron et al., 2007, p. 103). In this way, they showed how 'expertise' should be understood as being founded in fact-building rather than as an inherent property of being part of a profession. In this respect, they found that 'expertise' required a strong network of relations, the undertaking of local experiments, the production of specific inscriptions, as well as subsequent validation by practitioners. In this, they stressed that the production of 'inscriptions' in occupational practice sites, which were those operated by government audit offices, and the collective process of validation that subsequently took place in the practitioner community, were significant for explaining the construction of support networks around claims of expertise (Gendron et al., 2007, p. 101). In sum, Gendron et al. (2007) demonstrated what was also demonstrated by later studies, namely that expertise or actor-networks are fragile and costly (laboratory) constructions that require continued work.

In arriving at the above conclusion, another three key studies looked into this fragile characteristic of networks, but this time focusing on the unexpected effects produced by those networks as a result of their construction. This literature has drawn on Michel Callon's work, and especially the dual notion of framing and overflowing, framing being defined as the processes of setting boundaries around interactions, and overflowing being defined as those relations not contained within the frame (Callon, 1998a).[11] Christensen and Skærbæk (2010), for example, looked into the work of consultancies and the purification of accounting technolo-

[11] The first paper/analytical section and the third paper/analytical section elaborate more on these two concepts (see Sections 6 and 8; see also Skærbæk (2009) for a thorough application of these concepts).

gies. They showed how consultancies with their "scientific equipment" managed to "provide 'faith' to accounting systems and to settle controversies with sceptical and resisting groups that threaten to destabilize the innovations". (Christensen & Skærbæk, 2010, p. 524). In more detail, they showed how consultancy outputs such as consultancy project reports, seminars and briefings were key parts of the framing of accounting practices aimed at ensuring their smooth operation. The notion of purification here refers to the "processes that progress ideas toward acceptance and agreement where those ideas were previously" and adds depth to the dual notion of framing and overflowing by pointing to the work required to stabilise frames.[12]

Skærbæk (2009) also drew upon framing and overflowing and combined them with Callon's (1986) four moments of translation (problematisation, interessement, enrolment, and mobilisation). Callon defined those moments as the constitution of different phases "during which the identity of actors, the possibility of interaction and the margins of *manoeuvre* are negotiated and delimited" (Callon, 1986, p. 203). Skærbæk then examined how the National Audit Office of Denmark manoeuvred to make the Danish Defence Forces receptive to a performance-accountability project in the period 1990 to 2007. The case was that the Danish Defence Forces had initiated the implementation of a new accounting system called DeMars, which led to a stream of overflows, such as resistance from military officers, which destabilised it. Skærbæk contributed by showing how the National Audit Office, at least provisionally, managed to contain the overflows and stabilise the construction. He also demonstrated how this manoeuvring by the National Audit Office led to problems regarding their identity of 'modernizers' on

[12] I will get back to this later, as purification (framing/overflowing) has not been applied much in the accounting literature and thus represents an avenue for advancing our knowledge of the effects of accounting systems, such as risk management control systems, or accounting as a general phenomenon.

the one hand, i.e. participants in providing the reasons for change and defining its designs, and as 'independent auditors' on the other hand, i.e. agents of legitimising the construction in which they participated themselves. Skærbæk's case study, represented one of the larger studies carried out according to Latour's methodological principle about following actors "in action", a principle also insisted on by Chua (1995) and Preston et al. (1992).

Skærbæk and Tryggestad (2010) continued applying Callon's notion of framing and overflowing, this time looking into the role of accounting devices in performing corporate strategy and based on a case study of Scandlines, a Danish ferry company. Extending the works of Mouritsen (1999) and Briers and Chua (2001), they found that the accounting devices adopted did not only fit the strategy in a subordinate role, but that the adopted strategy was successively adopted in and mutually constituted by the accounting devices. They also found that contrary to common knowledge, the strategic actor or centre was not the CEO, but seemed to transgress such hierarchical boundaries. The strategic actor(s) was whoever was constituted as such as they acquired calculative equipment, such as accounting devices, which meant that sometimes it was management, sometimes people from outside the organisation. In sum, the corporate strategy was thus an "emerging calculative collective"; accounting devices were actively (as mediators) involved in enacting and framing an independent "outside", and in formulating and imposing a strategy of adaptation (Skærbæk & Tryggestad, 2010, p. 122); these devices performed corporate strategy by mobilising lay people and concerned groups.

There are also other key accounting contributions. Quattrone and Hopper (2005), for example, examined how a particular management accounting technology, SAP, mediated relations of distance, integration and management control in two

different organisations; Dechow and Mouritsen (2005) examined how two companies pursued the integration of management and control through enterprise resource planning systems that were actor-networks themselves and thus not only mere technologies, but made up of heterogeneous relations; these systems enabled and constrained what could be modelled and made visible through the ways in which they represented notions of space and time; Chua and Mahama (2007) examined the challenges that emerged when accounting control had to translate relevant dimensions of inter-firm alliances into performance/accounting measures; challenges that emerged due to accounting control being part of a larger network of relations that materially influenced its operation; and MacKenzie (2009) examined how greenhouse-gas emission markets were constructed, turned into prices and costs and made visible and exchangeable. In sum, these studies shed light on the notions of 'time' and 'space', 'distance' and 'integration', and demonstrated how calculation and technologies were fluid, transportable and constitutive parts of these notions.

In wrapping up this subsection, there seems to be one way (but probably also more) that current accounting literature could advance, drawing on actor-network theory. This relates to the above-mentioned concept of 'purification'. This concept can be used to shed light on the effects produced by accounting systems and not "just" how these systems have originally been produced through networks of relations. This latter aspect was the central contribution of many of the early key studies, such as Miller (1990, 1991), Robson (1991, 1992), Preston et al. (1992), but also later studies, e.g. Chua (1995), Mouritsen (1999), Jones and Dugdale (2002), Gendron et al. (2007) and Skærbæk (2009). These studies showed how accounting systems, or accounting per se, were fabricated through networks of relations, and tracked how, for example, accounting expertise or budgeting systems were con-

structed; i.e. these studies sought to explain the often taken-for-granted nature of accounting. In contrast to this, purification can be used to follow the effects or the work of accounting systems, the chains and trials they undergo. Latour (2004) calls this a shift from "matters of fact" to "matters of concern", or "a multifarious inquiry launched with the tools of anthropology, philosophy, metaphysics, history, sociology to detect *how many participants* are gathered in a *thing* to make it exist and to maintain its existence" (2004, p. 246).

Latour does not think that we should remove ourselves from studying associations; on the contrary Latour assumes that rather than focusing on the networks of actors that have brought the "thing" into existence, the focus should be even more strongly on the "thing's" associations. This was also shown by some of the above-mentioned studies. Skærbæk and Tryggestad (2010), for example, followed how accounting devices performed strategic options and mobilised various groups of actors in mutual constitutive relationships, and thus how these devices entangled and disentangled, attached and represented, with other actors over time; and Quattrone and Hopper (2005) demonstrated how it was SAP's attachments and not SAP itself that constituted its identities, which also differed between two organisations. In this respect, other concepts than purification can be used, but concepts that focus on how accounting systems, inscriptions, accounting as a phenomenon, etc., associate, attach, gather and entangle with other actors, represent an interesting avenue to advance our knowledge. In this respect, Callon's notions of framing and overflowing (Callon, 1998a), but also that of performativity (Callon, 2007, 2010) represent concepts that could be used to do this (See also MacKenzie, 2006, 2007, who applied this to financial accounting and the construction of markets).

5. Method

To continue the observations made in the previous section, because of its particular theoretical assumptions, actor-network theory has methodological implications for researchers who want to stay loyal to its basic conception. The previous section indicated this several times by stressing the notion of focusing on associations or translations and following the actors "in action". This section begins by first recapping the methodological stand of actor-network theory. The second subsection describes the method chosen: (two) case studies. The third subsection looks into what I term "units of analysis", which refers to the "who, what, when and where" of the study. The fourth subsection looks into the "how" of the method, meaning what data collection techniques I employed to arrive at my findings and the consideration I gave their application. The fifth subsection contains my reflections on what it means to study mega-projects, and also what my participation did to the information I collected. My claim is that I did not interfere with what I studied, but it follows that when one follows a practice over a longer period of time, it is not possible to remain completely detached from those involved and thus potentially influence them. I end this section by describing some of the limitations of the "following the actor" approach and of listening to actors hands-on.

5.1. Overall methodology of actor-network theory

> "It is a capital mistake to theorize before one has data. Insensibly one begins to twist facts to suit theories, instead of theories to suit facts".
>
> – 'A Scandal in Bohemia', Sherlock Holmes

If we disregard the fact that Sherlock Holmes was looking for criminals with all that entails, the above passage from Sir Arthur Conan Doyle's (1891) "A Scandal in Bohemia" might as well have been taken from a Bruno Latour description of actor-network theory's methodological stand. In "Reassembling the Social", for example, Latour wrote: "At this point, the *last thing* to do would be to limit in advance the shape, size, heterogeneity, and combination of associations ["to theorize before one has data"]" (Latour, 2005, p. 11). Instead, Latour argued that scholars had to start by paying attention to actual empirical details and not draw any conclusion until after having examined them thoroughly. In that sense, however, Latour would disagree with Sherlock Holmes that theorising was to present "solutions" to problems, meaning that what we need to arrive at the "truth" of something. Latour would insist that theories are no more than extensions of already existing networks of relations; there are no absolute "truths", nothing behind the curtain; only associations, and then more associations. Latour turned away from pragmatism and headed towards relational constructivism. As with most turns, however, it was not at all straightforward. It all began with a misunderstanding:

> *"ANT is the story of an experiment so carelessly started that it took a quarter of century to rectify it and catch up with what its exact meaning was. It all started quite badly with the unfortunate use of the expression '**social construction** of scientific facts [my emphasis]". Latour (2005, p. 88)*

In "Reassembling the Social" from 2005, referring back to the subtitle of "Laboratory Life" from 1979, Latour wrote that the expression '*social* construction' had unfortunately been used to describe the philosophy of science underpinning actor-network theory. In 1979, "Laboratory Life" had the subtitle: "The Social Con-

struction of Scientific Facts", but fellow academics had mistaken it as referring only to human (and not *all*) interactions (Latour & Woolgar, 1986, p. 281). In 2005, Latour attempted to correct this misunderstanding by "Reassembling the Social", which is also the title of his book. In this book, Latour argued in general terms that current social scientists had used the adjective 'social' to describe both the processes of assembling and the nature of what was assembled (Latour, 2005, p. 1). He then showed how 'the social' could not be understood as a kind of material out of which things were made and returned to the original meaning of 'the social' as the *tracing of associations*. In having redefined the notion of 'the social' this way, Latour argued that actor-network theory indeed represented a social constructivist approach, but taking the common understanding of 'social' into account, he "contended" with actor-network theory being a *constructivist* approach.

In actor-network theory, constructivism refers to the "account for the solid objective reality by mobilizing various entities whose assemblage could fail" (Latour, 2005, p. 91). Latour illustrates this by referring to a building. He describes that a building can be understood as the assemblage of a range of human work on materials such as clay bricks, wooden planks and steel beams. It is not enough to understand this as only human work. Neither is it enough to understand it simply as the work of humans on materials; the materials are important actors, but they also have to be shaped in order to look like a building. A successful construction of a building thus depends on its associating abilities. In the words of Latour, humans and non-humans together have to be mobilised in a specific way, and only when this has been accepted or recognised by other actors, the building has achieved its "objective reality" as a building. Callon would say that the interaction between human and non-human actors would have to be framed in a specific way to be successful in becoming "a building" (Callon, 1998a).

The point I seek to illustrate is that it is the *association*, the relation between entities which is crucial for understanding, for example, practices of risk management. A building is not an a priori kind of social material, it is not a pre-given entity, it is an assemblage, a temporary, stabilised process, and one that can always be "demolished". It depends on the continuous mobilisation, the assembling of entities. In this, actor-network theory becomes "a method to describe the deployment of associations… a method to describe the generative path of any narration" (Latour, 1996, p. 374). It is about trying to catch up with actors' "often wild innovations in order to learn from them what the collective existence has become in their hands, which methods they have elaborated to make it fit together, which accounts could best define the new associations that they have been forced to establish" (Latour, 2005, p. 12). It is by doing this that we come to understand the "objective reality" of, for example, practices of risk management. In my approach to examining practices of risk management, I have been guided by this point. In overall, this means that what I do is seek to *trace associations*.

To operationalise this "tracing of associations", Callon (1986) has developed three methodological principles. The first concerns 'agnosticism'. It entails that the scientist, or observer, must remain impartial among actors engaged in controversies, must not censor actors as they speak about themselves or any other matter of their interest, and must not judge an actor's statement or analysis (of the social environment). The second principle refers to 'generalised symmetry'. This principle refers to the rule that the observer must not simply repeat the analysis suggested by the actors he is studying; the observer must use a single repertoire applicable across all actors to make sense of his findings. The repertoire chosen can be left to the discretion of the observer, but the observer must select the one that seems the

best suited to his task at hand. The only requirement is that the selected repertoire must be capable of capturing the work of both human and non-human actors and that it thus does not give any actors priority over other actors. All selected vocabularies are equally valid, but the observer must afterwards convince his colleagues, through his writing, that he made the right choice. In his 1986-paper, Callon chose the (generic) vocabulary of "translation" (Callon, 1986).

The third and last principle concerns 'free associations'. This principle demands that the observer must abandon all a priori distinctions, such as those between nature (or the natural) and society (or the social), human and non-human, agency and structure, macro and micro, description and explanation, far and close, strong and weak, etc. Instead, the observer must remain open to the examination of associations (and then treat distinctions as effects of these associations, if this is at all relevant). In addition, the observer cannot impose any type of pre-established analytic grid on associations; the observer must "follow the actors in order to identify the manner in which these define and associate the different elements by which they build and explain their world" (Callon, 1986, p. 201). The observer must describe the associating works of actors and then on the basis of gatherings of such associations construct and reconstruct the actions and events that make up the actor-network studied. In this sense, Callon's principle of 'free associations' relates to Latour's concepts of mediators and intermediaries, i.e. the observer must remain open to examination of all types of associations, but only those that mediate to other associations will be visible (See also Callon, 1998b, pp. 9-10).

5.2. Method: case studies

In choosing a method that enables me to adhere to Michel Callon's above-mentioned methodological principles, I have chosen case studies, understood as

in-depth and detailed descriptions of real-life situations. In the words of John Law: "[actor-network theory] is grounded in empirical case studies", and we can only understand actor-network theory "if we have a sense of those case studies and how these work in practice" (Law, 2009, p. 141). In relation to the tracing of associations, the by far largest benefit of choosing case studies is that it allows going into the details of "messy" practices. It allows following the actual associating work as it unfolds through time and space rather than limits to following only the outcome of such processes, which amounts to either stabilised associations, or none. It allows going "behind the scenes" of formal written documents, such as financial reports, which tend only to demonstrate the type of information that key actors have agreed upon. As I seek to examine the construction of practices of risk management, the effects they produce over time, and how we can understand them, going into actual "messy" practices seems imperative for making a solid contribution. At least it allows me to provide thick empirical details and to look "beyond the enterprise" (Miller, 1991, p. 757) and into "the particularities of risk management characteristics in specific organizational settings" (Bhimani, 2009, p. 4).

I have already described the two cases I have decided to draw on: the Danish DKK 23.7 billion railway signalling renewal project, called the Signalling Programme, and the Danish DKK 41.4 billion hospital construction programme, called the Hospital Programme. These two projects are both mega-projects in terms of having high public attention and a budget of more than USD 1 billion. I have also explained that the Signalling Programme was chosen because it adhered to the fundamental actor-network theory's methodological requirement that a case be chosen in which the associations have not yet been black-boxed. This means that something new must be present, something changing, something that someone or some*thing* holds relevant as important and which transforms that which it was

supposed to transport. The Signalling Programme represents such a case, as it was the first programme that was subjected to the government requirement to implement comprehensive/holistic risk management. This meant integrating this principle across all subprojects, and at the strategic top management level as well as at the operational project management level, which only few of the involved actors had attempted before, and then only on a non-required basis. This enforcement of risk management led to controversies and many other trajectories over time.

The Hospital Programme similarly represents a programme in which risk management had to be implemented and where the actors did not know how to approach it; this time, however, the requirement was not caused by legislation, but by earlier construction scandals. These scandals had led the National Audit Office of Denmark to recommend the implementation of risk management in order to strengthen management accounting practices. It had also led the Hospital Programme to acquire assistance from KPMG, who also strongly recommended the implementation of risk management. The Hospital Programme is further been divided into 16 major hospital construction projects, which are each managed separately by local project management organisations under the auspices of the five Danish Regions. In practice, this division meant that not one, but 16 project organisations (and thus many more actors) were faced with practising risk management for the first time, which all things being equal resulted in a multiplication of the complexities of implementing and operating risk management, compared to the Signalling Programme. In other words, these not-one-but-sixteen practices were indeed “messy” and far from being black-boxed.

5.3. "Units of analysis"

This leads me to describe the "who, what, when and where" of my method, or what I call the "units of analysis". This and the following subsection focus on the Signalling Programme, as this case is my main case and because I have spent by far more time collecting data from this project. As I stated earlier, my two co-authors on the third research paper, which deals with the Hospital Programme (together with the Signalling Programme), have conducted most of the observation studies and all the interviews related to this programme. The initial considerations made regarding selecting the proper "unit of analysis" and the subsequent collecting of data have therefore been done by them. In contrast, I have been solely responsible for deciding on the "units of analysis" and how to approach the collection of data related to the Signalling Programme, and therefore this section focuses on this. This includes the consideration I gave to carrying out the data collection, as well as the consideration I gave to my own role in the Signalling Programme, plus the limitations of following and describing associations.

With respect to the Signalling Programme, I followed Latour's notion of "following the actors", meaning that, as in the studies by Preston et al. (1992), Chua (1995) and Skærbæk (2009), to mention three key accounting studies, I traced associations between actors that were involved in practising, in my case, risk management. This "following the actors" perspective, however, poses two major problems: (1) where should this tracing begin, and (2) how do you know when you have "completed" the tracing? In answering the first question, Latour wrote that you always start in the middle of things, "*in medias res*", and that "that is excellent because *there is no better way*" (Latour, 2005, p. 123). There will always be things you will not know, always be "crucial events" that took place before you arrived, always be things you thought you knew, but which you actually did not know; and

after weeks, months or years of data collecting, you have to realise that most of the gathered descriptions must be sacrificed to fit the small number of pages related your writing format. So what did I do? I began by looking at Rail Net Denmark's website, http://www.bane.dk, and more specifically the section which at that time contained information about the Signalling Programme.[13, 14]

This website provided me with scarce, but still very useful information as it presented the key project managers and the programme management of the Signalling Programme and also contained much background material on the programme. This gave me an overview of the people that I knew I had to attempt to make contact with. At the time, however, I did not have access to Rail Net Denmark or the Signalling Programme organisation, so it was crucial to first establish contact. After this had been established, a meeting was set up at the beginning of 2010 with the board of directors of Rail Net Denmark (and not just the Signalling Programme organisation). At this meeting, it was agreed that I would get access to the Signalling Programme, its employees, its internal documents, etc. I also received hundreds of pages of background material for the Signalling Programme including material for the recently constructed risk management practice, which I went back home and read (which included Booz Allen Hamilton, 2006a, 2006b, 2006c; and Banedanmark, 2008a, 2008b).

After the initial board meeting, I made contact with the then risk manager (who was later moved to a different position due to re-organisation), the senior consultant in charge of risk management, the programme director and two senior project managers. I held interviews with them, and it was agreed that I was to follow all

[13] See the first half of the section "Preface" for a more elaborate description of what I did, as this dates back to before I began this PhD dissertation when I were about to write my Master's thesis.

[14] For the English website, see: http://uk.bane.dk.

formal risk meetings for the remaining part of the Signalling Programme (until 2020/21). It was also arranged that I would follow the day-to-day work of key project managers; this was dropped, however, as it became evident that only very small parts of their work related to actual risk management.[15] It was also arranged that I was to conduct interviews with two more key actors who had been involved earlier, but who now had left the organisation. I did those interviews later. In addition, it was agreed that I would use the risk meetings to establish new contacts, as the practice had been organised so that all parties involved with risk management would at some point be invited to these meetings. I met 79 people this way, most of whom I met on several occasions.

I will not go into my entire "network-tracing" activity, as it will be too comprehensive to account for and make comparatively little sense to the reader. I did establish a journal in which I noted down when I met the people I met, their job function, at what kind of meeting I met them, the number of times I met them, their full names, etc. I will comment more on this when I explain how I approached participating in the meetings I did. I did not make notes of when and how I got hold of all the documents I did, but I scanned every single internal document I got hold of (unless I was told not to) and filed them. I also carried out systematic reviews of newspaper articles on a bi-annual basis; I downloaded all the formal documents I could find, I asked people for documents I heard mentioned or read about in other documents, I e-mailed people later on about this when I got to know them; and I tracked the people I heard mentioned more than once or twice

[15] In 2011 and 2012, this was taken up again on two different occasions; the former again related to following project managers, which ended up being dropped for the same reason as stated above; the latter related to following one of the risk consultants during his/her work when he/she was present at "Banehuset" (the main building of Rail Net Denmark). I did that for one day, but because this work resembled what I had already learned from casual chats after meetings and from interviews, I dropped continuing this.

(as many people's named were dropped in conversations) and approached them for interviews. Finally, I also followed the report "trails", meaning that I approached the people or their organisations that, for example, had produced or received the report.

I have included three appendices that *re*-present the people I met along the way. I have excluded the names for reasons of confidentiality, but have kept their job titles to demonstrate the extent of the actor-network traced. A few notes on this are appropriate here: One, I attempted on several occasions to make contact with the Danish Ministry of Finance, and I even had people from within Rail Net Denmark and the Danish Ministry of Transport to attempt this on my behalf. So far, it has been unsuccessful, and I am therefore still attempting to do this. Two, I never found traces of the involvement of the National Audit Office of Denmark, except for the period before the Signalling Programme was approved, even though I asked people explicitly about this. I find this lack of involvement surprising. Actors have explained that the reason is that the Signalling Programme has remained on schedule and within budget (and has even returned money to the state). I have not pursued this further, again here adhering to actor-network theory methodology, as I have "followed the actors" who made a difference, the mediators, and I have found no indication that the Audit Office was such a mediator.

The lack of involvement by actors who at a first glance would be considered important to the project brings to mind one important actor-network theory point, namely that actor-networks are never stable: new actors can be involved, some can lose their effect, some betray the practice, etc. This means that the actor-network described throughout this dissertation must not be regarded as a permanent list of the important actors in the Signalling Programme: these actors were important at

the time they were recorded, there could have been more, and there certainly will be more as the programme keeps developing. This leads me to the second question posed by Latour: How do you know when to stop your network tracing activity? Latour himself explained that there is no final answer to that question. In a recorded dialogue with a PhD student, Latour responded to this question by saying: "You stop when you have written your 50,000 words or whatever is the [dissertation] format here, I always forget" (Latour, 2005, p. 148). Latour thus stressed the practical constraints that always go with writing texts, such as the dissertation format or the time available. In that sense, I have never stopped my collection of data; I have attempted to collect as much information possible within the limitations of the available time, the willingness of the actors to participate etc. *After* my collection of data I have then posed more specific research questions that would capture the associations I traced, without losing the complexity of these (see the three research papers for those questions).

In summing up this subsection, I did not pre-define the actors to be involved, but rather traced associations according to Callon's methodological principles of "free associations", focusing on the actors' own descriptions of their worlds (of risk management). I further traced all actors, both human and non-human, according to the effects they generated, thus leaving out the intermediates and focusing on the mediators (Latour, 2005, p. 128). I should mention that an important mediator that underwent massive transformation was the IT-based risk management control system that had been implemented to assist the operation of the risk management practice. I will later in this dissertation describe in more detail how this actor translated and brought other actors into existence. It was thus not only humans, or more specifically, employees, that I followed, but also all sorts of other actors. I followed actors such as project managers, programmers, consultants, suppliers,

civil servants, financial controllers, managers, newspapers, databases, projectors, presentation material, laptops, risk agendas, status reports, white papers, decision reports, investment proposals, audit reports, to mention but a few. See Appendices 7 and 8 for overviews of human actors traced. See also primary references in the reference list for key non-human documents. Otherwise, I refer to the three research papers for descriptions of other non-human actors like the IT-based risk management system.

5.4. Data collection techniques

This subsection describes the data collection techniques I employed, which include three formal techniques: collection of documents, semi-structured interviews and non-participation observation studies, and a range of more informal techniques. The latter techniques include email correspondence with key actors, casual conversations before and after risk meetings, as well as during breaks, confidential conversations held without the recording devices turned on, conference attendance where people from the Signalling Programme would be present, informal observation of people working at their work stations, as well as lunch-break smalltalk. These techniques have all been employed with due consideration to the above-mentioned methodological principles. In the following, I will refer to data as information.

5.4.1. Collection of documents

The first and most important information tracing technique employed is the collection of documents (Callon, 1991). I have collected several hundreds of pages of written documents related to the Signalling Programme and its practice of risk management. These documents include both “external documents”, such as the background and investment reports, but also “internal documents” such as pre-

pared risk status reports or meeting agendas. I approached the challenge of collecting documents by first downloading all the documents I could find on the Rail Net Denmark homepage, http://www.bane.dk. This provided me with background information on the Signalling Programme, including information on technical solutions, financing, risk management, contractual strategies, organisation, stakeholder coordination, as well as numerous references to other documents. I then proceeded by looking into those references that were mentioned repeatedly, which led me to information about the "New Budgeting Method" and the formal documents surrounding it. In sum, this slowly led to more and more documents being collected, including government white papers, auditing reports, traffic agreements, consultancy reports, legal instruments, etc.

I have referred to all those documents I could find that pertained to the bringing into existence of the Signalling Programme and its practice of risk management. I thus adhered to the actor-network theory's methodological principles. As I was doing so, however, I was also becoming still more involved in day-to-day developments. This meant that I also began to collect "internally" produced documents such as risk status reports, project status reports, strategic risk plans, presentation material, internal classified reports, charts, etc. These documents provided me with knowledge of the formal information that was produced inside the organisation and to whom it was circulated; sometimes to project managers, sometimes to programme management, sometimes to the risk management team, and sometimes to the Ministry of Transport. With respect to the first paper, which deals with the translation of uncertainties into risks, this provided me with specific information about the risks that were constructed, which I was then later able to compare with the processes by which they were constructed. In connection with the second paper, which focuses on the relationship between frameworks and practices of risk

management, the documents provided me with information on the formal aspects of the construction and re-construction of the Signalling Programme's risk management practice; and for the third paper, which deals with risk management, uncertainty and the roles for knowledge and project management across my two examined mega-projects, the documents helped me to understand the similarities and differences between the two programmes.

Besides the above-mentioned hard-copy documents, I also collected electronic documents that were circulated through emails or the Outlook Calendar meeting invitation function, where documents could be attached. I attempted to obtain as many of these documents as I could get my hands on, although I recognised that most of this type of information was inaccessible for me. These documents included risk meeting agendas, risk status lists, overviews of risk reducing actions, 'value at risk' charts, overviews of risk assessment classifications, reporting standards, etc. I used most of these documents to get an understanding of the meetings before I attended them, the overall status of risk management, its development over time, and the key actors of the practice (as I got to know who the participants were). This information was all extracted from the IT-based risk management control system. I therefore made sure that I gained access to this, also in order to follow how this information was extracted. In relation to the second paper, this access was what enabled me to draw conclusions on the importance of the control system and to produce the description of 'value at risk' developments. This access also enabled me to contrast output information with the input information on the construction of risks that I obtained through observations (see next subsection).

By connecting the documents to the overall research question, I was able to describe in great detail how the practice was framed, that is, how the practice of risk

management was constructed, *and* how it changed over time. The "external" documents illustrated the broad, overall background information, while the "internal" and electronic documents showed the more local and specific elements of this construction. However, this leaves out the important part of the "following the actors" principle, namely the processes taking place before the production of documents. Consequently, I have supplemented the gathering of information from documents with the technique of conducting observation studies. The documents did provide an understanding of the roles of the different actors, when and where risk management was practised, the purpose of the practice, how to define the notion of 'risk' and 'risk management', but not the effects of the processes of actually carrying this out. The documents "black-box" the actual empirical developments taking place, the frustrations, negotiations, disagreements, etc., that form an integral and important part of the practice. In order to answer the second part of my overall research question about the effects of the practice over time, the collection of documents thus cannot stand alone as a collection technique.

5.4.2. Observation studies

The second technique relates to the conduction of observation studies. As mentioned before, I have used this technique to allow me to "follow the actors", i.e. to follow the associating work of actors related to the practising of risk management. This includes the conversations, discussions, negotiations, conflicts and everything else that may take place between actors that would have remained hidden if I had not pursued this. In relation to the research question, the observation studies have enabled me to examine the effects generated by the processes of practising risk management. In relation to the first paper, this has allowed me to compare the construct*ed* risks with the construct*ion* of risks and thus the things that are debated, disagreed upon and perhaps excluded. This may reveal unexpected effects. In

relation to the second paper, the observations have allowed me to examine the relationship between the ways practices are framed and the ways they are actually carried out; and in relation to the third paper, they have allowed me to examine the effects of practising risk management on the conditions of the knowledge and the role(s) of project management.

The observation studies were conducted as non-participating studies, meaning that I never interfered in the interaction taking place. It did happen that people asked my opinion, but unless I was asked about my name or other simple matters not related to the practice of risk management, I refrained politely from answering. The majority of all observation studies were conducted at different types of physical risk-related meetings (see Appendix 6 for an overview of observation studies). It was in these meetings that actors would identify and describe new risks, reconsider the status of already existing ones, assess risks according to the logic of probability and consequence, describe and follow up on actions taken to reduce risk, distribute risk ownership, evaluate progress, close risks as needed, solve conflicts, discuss opportunities for improvements, approve or disapprove of risks, coordinate further meetings, etc. In sum, I observed the construction of more than 500 risks and hundreds of risk-reducing actions from 79 different risk management involved actors, many of whom were observed more than once, in 41 different meetings (see Appendix 7 for an overview of observed persons). These persons were most of the studied actors of the practice, because it was exactly through their participation in these meetings that they were brought into the practice.

At the physical risk meetings I took extensive field notes. I never recorded the meetings, as the programme management and the head consultants did not want the participants to deliberately avoid speaking about sensitive or confidential in-

formation (such as contractual prices). I agreed to this, and in the first 14 meetings I used pen and paper to take down notes. I was later granted permission to use my laptop, which I did in the remaining 27 meetings. After the meetings, I would transcribe my notes in order to forget as little as possible. I would also write down the numbers of risks included, dividing them into new risks and reassessed risks, and also write down the number of risks excluded, dividing them into duplicates, new, and closed ones. I would also note down the number the risk was assigned in the control system, so that I could search on these numbers later in order to follow the risk's development over time. I used the "included/excluded" information in the first paper and stopped noting this at meeting no. 30, as this was where the first paper stopped due to the boundaries defined by its research question. In the last two years, new and different types of meetings were added that were not about producing risks but rather about reassessing the practice per se (risk forums) or approving risks (approval meetings). In total, I produced more than 400 pages of transcribed observation notes over the four year study period.

In 2012, the IT-based risk management system underwent a restructuring. The control system could now be engaged by the users themselves through the Internet, which allowed them to construct risks and communicate online. In response to this, I therefore also began conducting observation studies "at-a-distance", meaning that I was now able to follow the construction of risks from my laptop without being physically present in the meeting room. The consultants operating the practice still held regular risk meetings in which risks constructed online were reassessed, so the physical meetings were still very much relevant. From 2012 and onwards, however, I always cross-referenced my notes from the meetings during transcription with changes made to the control system online after the meetings in order to make sure that I captured all elements of the interactions noting down

both my observations from the meetings and the changes made after when this was the case. This cross-referencing sometimes revealed interesting findings, for example when changes were made to the system that did not match the description put forward in the meeting. This discrepancy sometimes led to unexpected effects, as when risk ownership was distributed to the wrong person or when assessments were registered as being higher/lower than described. In sum, 23 observation studies were cross-referenced like this and notes taken on any discrepancies.

5.4.3. Semi-structured interviews

The third and last source of information is interviews. I have conducted a total of 19 interviews with different risk-involved individuals, including risk consultants, the programme director, project managers and civil servants to mention a few (see Appendix 8). I did contact more potential interviewees than these, but most of them never responded to my emails or cancelled our meeting – and those I did interview often required me to schedule more than one appointment before we managed to meet. The interviews were all semi-structured, which means that I produced an interview guide with the questions I wanted to ask, but at the same time I made sure that the questions were open-ended. The purpose of choosing semi-structured interviews was to limit the discussion to risk management related matters while at the same time allowing the interviewees to speak freely about the things they found interesting in relation to this subject. I further refrained from predefining the length of the interviews, which meant that there was no pressure on me to interrupt the interviewees' answers to get my questions answered, and no pressure on the interviewees to limit their own descriptions, which allowed them to talk for as long as they wanted. In practice, this lack of time pressure led to interviews of varying length between on average one to two hours (see Appendix 8).

In my approach to the interviews, I also always asked the interviewees up front whether they would permit me to record the conversation. I would always stress to each interviewee that if they were going to be quoted, their contribution would be anonymised to prevent them from being recognised. All interviews were recorded. The fact that I recorded them, however, meant that several actors would tell me before the interviews that they could not guarantee that they would be able to answer my questions in all details. My response to this was to explain to them that I needed to record the interview as part of a proper academic conduct, but we agreed that we could continue the conversation afterwards. In practice, I often had long talks after the recording had been stopped, which allowed me to learn much new information I would not otherwise have gained access to. I promised not to quote that information or to divulge who had given it to me, which is the reason why I have not provided an appendix on this as I did with the number of interviews and observations. However, nothing prevented me from trying to obtain that knowledge elsewhere, in fact I was encouraged to, such as by explicitly asking other people about this or collecting documents containing that information. In accordance with the actor-network theory's mantra of "following the actors", I followed that trail multiple times, which almost always led to more "usable" sources of information.

In adhering to Callon's (1986) principle of 'agnosticism', I have strived not to ask questions that would make it seem as if I was siding with specific actors. I have always stressed that I was there to explain and make sense of the practice of risk management as an independent and impartial academic (and thus I sought to explain that I did not have any other agendas). I have also always avoided explaining my working hypothesis or ideas, as this might affect the interviewees' responses, just as I have been careful not to let the working hypothesis and ideas affect the

way I asked my questions. I further emphasised before all interviews that the interviewees were free to decide whether they wanted to participate or not and that there would be no repercussions or hard feelings. I did stress that I had the programme management's approval to be in the organisations, but I did that to encourage them to speak freely about confidential matters they would otherwise have left out. I also made a point of stressing to them that if they later regretted doing the interview, or wanted to retract certain statements, I would always respect that and refrain from using the interview or the retracted statements. In practice, no interviews were retracted, but some statements were altered in the transcription due to the often quite graphic language used by interviewees to underline their opinions.

The interviews were afterwards transcribed, in the sense that I listened to the recording and wrote down everything, from what was said, to laughs, interruptions, and non-verbal communication. With respect to the latter, I took photos of whiteboard drawings and had the interviewee email documents referred to during the interview, which I then inserted into the transcription, etc. I attempted to capture everything I could think of during the interviews and the subsequent transcription. When using exhibits, such as quotes, from those interviews (and this goes also for the observation studies), I always did my best to translate them into more readable sentences, including translating them from Danish into English. In addition, I always explained to each interviewee that I would email the transcripts to them afterwards to allow them to validate the content. This provided me with the opportunity to ask them follow-up questions on things I was unclear about, which I did on some occasions. It also provided the interviewees with the opportunity to elaborate on statements and/or retract statements as mentioned above. In practice, not much new information came out of this, but it did on some occasions help me cor-

rect things I thought I had understood. In sum, I ended up with approx. 600 pages of transcribed interview data (or about 1000 pages including the observation notes mentioned above).

In analysing the transcripts, I have adhered to Callon's (1986) methodological principle of 'free association' which means that I did not apply any analytical grid to pre-determine what information would be relevant. Instead, I went back and forth reading transcripts, doing more interviews (and observations), reading the transcripts again, looking at documents, following the IT-database system changes, listening to the interviews, reading the transcripts again, and so on and so forth throughout the four years I carried out my network-tracing activity. I have not applied any formal IT-based coding software either. I used notes to my transcripts combined with "comments" inserted into the document; I drew timelines, gave numbers to risks and triangulated my notes with the IT-based risk management system. I listened to the actors, did not privilege any of them, did not pre-select them because of their titles (expect when I approached the organisation for the first time), did not predefine their importance just because some were louder than others in meetings; they were all the result of my network-tracing activity and not the other way around. In combination with the two other formal techniques (and the informal ones described in the next subsection), this allowed me to get an understanding of the activities and events that formed the practice of risk management, in this context not to be understood as being limited to the boundaries of the formal established practice.

5.4.4. Other data collection techniques

Besides the three formal data collection techniques mentioned above, I also collected information, or traced actors, using a variety of other more informal tech-

niques. One was the many small-talk conversations I had with various participants in risk meetings before, during and after meetings – especially when meetings were delayed, postponed, or otherwise rescheduled. This provided me with valuable information about actors, who they were, how they perceived risk management, and generally helped me to find my way around the organisation. These conversations were also valuable for locating new actors to interview and to figure out what were the interesting questions to ask, and how people felt about the whole risk management practice. I also participated in two large practitioner's conferences, the "International Risk Management Conference", 1 December 2011, and the "Danish Rail Conference 2014", 14 May 2014, both held in Copenhagen, Denmark. This gave me the opportunity to meet people involved in the Signalling Programme, but also other people from different organisations, and learn more about other approaches to risk management and larger societal developments.

As I got to know people better, I also started having informal (or perhaps formal, but information provided here was never quoted) email correspondence with key actors, who would send me written material, information about upcoming events and the like. This provided me with new documents, new contacts, clarification of things, and more. It also served to build closer contact with people, something that I discuss further in the next subsection. I also had smalltalk conversations with people walking from building to building between meetings and during coffee breaks, as well as with people at their workstations after meetings. Lastly, as mentioned earlier, I also followed one of the risk consultants around for one day, but because this added little new knowledge to what I already knew, I stopped doing this and decided to pay more attention to other things, such as scrutinising status reports, attending formal meetings, and following changes made to the online-accessible IT-based risk management control system from 2012 and onwards. In

sum, all of these informal data collection techniques allowed me to sharpen my knowledge about which meetings it was best to participate in and who to interview, and it also gave me knowledge about the things that went unsaid.

5.5. Reflections on my own role

It is obvious that when one meets the same people for a longer period of time, irrespective of the situation, it becomes increasingly difficult to remain an "impartial, neutral observer". In this subsection, I discuss the major occasions on which I was drawn into the practice and how I subsequently dealt with this. I have done this to demonstrate that I am well aware that all descriptions of networks necessarily must extend these. This subsection thus shows how I ended up affecting the very network I attempted to describe without interference. In the beginning, however, this rarely happened. At meetings, people would acknowledge my presence by greeting me, but in all other aspects, they would conduct the meetings without looking at me or speaking to me, which for me indicated that they were unaffected by my presence. It did not take many months, however, before people learned about what I was doing and would sometimes say things that were hinted at me to make sure I wrote them down. The most obvious example of this was when, during an assessment of a risk, a senior consultant from one of the subprojects interrupted the risk consultant who had organised the meeting and whispered to me that the risk they had just assessed as "red" was actually "yellow", but that it was important for him to flag it as "red" in order to get the management's attention.[16]

It was rarely more than that, however, and I noted it down into my meeting notes whenever this happened. In the last year or so of my network-tracing activity,

[16] In consequence, I should mention that the risk consultant organising the meeting overheard that comment and challenged the senior consultant from the subproject to reconsider his assessment, which he did with a smile.

however, due to the high turnover rate of project managers, I moved from being "the new guy" at the meeting to being the "academic expert" who had been there from the beginning. And truth be told, I had been there since the programme had consisted of seven people, and towards the end it had more than 120 employees, and just as many external people who came and went. I would therefore start hearing comments like "if you don't know what to do, ask that guy" and the senior risk management consultant even once, although in jest, proposed that I could manage the upcoming risk meetings if he fell ill, because I had more experience than any of the other (junior) consultants. On several occasions I also began to note when the participants forgot things; as when information was filled into the wrong field in the IT-based risk management control system; or when the explanations given by junior consultants to project managers about how to do risk management were wrong compared to how the practice had been framed.

Although I appreciated the kind of trust that was now shown to me, it also made me aware that I had to be extra careful about not saying anything during meetings. I therefore did not do that, and I continued to stay in the background without taking any part. Outside meetings, I attempted to do the same, but (naturally) more and more interest started to build up concerning my findings. I was still very determined not to speak about this, but as I judged that having the trust of the people around me was more important I did begin to share my findings, although I was very careful to only give this to people I had already observed multiple times, or already had conducted an interview with. I also made sure to only give information to those people I had met several times *and* whom I knew also provided me with information they did not necessarily have to give (thus those I trusted). I must stress that I never provided normative suggestions on how to improve the

practice, although I was often asked to, and nor did I share any confidential information with people from outside the Signalling Programme.

In all aspects I found no evidence that explaining the things I observed made the strategic centre of the practice (the programme management, senior consultants, and ministries) alter the way associations were drawn. In 2014, however, I agreed to give a formal presentation of my three research papers, which included pointing out findings like limitations, constraints and unintended effects of the established risk management practice. In this meeting, many of the key actors I had met along the way attended, from consultants, to head project managers and members of programme management. While I do not know the outcome of this meeting yet, looking back I have to conclude that I was no longer the "neutral observer" I once thought I was, but very much an active mediator of the actor-network I had been studying. Unwittingly, I had added to the network, as Latour (e.g. 2005) writes that all good texts must do because it cannot be otherwise if texts are not to be intermediaries and thus unimportant. Looking back, I therefore only see this involvement as positive, although it does cause practical challenges that have to be overcome so not to affect those that I have been following too much.

So what did I learn? I have learned that studying risk management in a large *public* capital investment programme requires sensitivity to the multitude of stakeholders involved; everybody who has something to gain and to lose. This require that one never privileges one group of actors, but remains impartial in order not to risk getting mixed up in political power plays. I have also learned that believing that risk management is practised only through formal practices implemented in its name captures little information about the actual handling of uncertainty. In these types of projects, uncertainty prevails at every corner; and uncertainty (not risks)

is handled in many places within *and* outside the main project organisation. In relation to the first point about the importance of understanding the multitude of stakeholders, dealing with uncertainty involves dealing with political decisions that are far removed from the work of the project managers, and vice versa, technical decisions being made at the operational level are far removed from the world of politicians; and all carry uncertain elements that interact when mega-projects such as the Signalling Programme are undertaken. It involves actors such as the National Audit Office, the Ministry of Transport, the Ministry of Finance, consultancies, project managers, controllers, train operators, contractors, suppliers, sub-contractors, sub-suppliers; but also actors such as communication units deciding to develop smoke, trains not braking, IT-systems breaking down, doors being kicked in, and much, much more. Dealing with risk and uncertainty means dealing with all of these – that is, continuously for the 11 or 12 years that the Signalling Programme has been scheduled to last until its completion.

5.6. Practical challenges

Consultant (X2): "X79, you are the new guy, any problems?"

Consultant (X79): "Do I have problems! I have so many overdue [risk] actions because I do not understand what's going on and I cannot even seem to give any intelligent responses. This thing [the risk system] is so difficult and filled with acronyms that it's hard to understand the risk descriptions. I had one [risk] and I didn't understand the first seven words of its description because they were all acronyms!" [Laughs from around the table].

Consultant (X77): "I have the same issue".
Consultant (X2): "I think we all have that issue".

As I have stated many times before, I have "followed the actors" as my overall approach to conducting the case studies. I doing this, I have been confronted with the challenge of grasping what the actors were describing. It often followed that highly technical terms were used to describe uncertainties and risks, but also the project, its subprojects, its progress, and project management / engineering work in general. As the above exhibit taken from a conversation between three risk consultants shows, it was not just I who had that problem. However, it still does not take away that "following the actors" can be quite difficult at times. Just to mention some of the more common acronyms: ERTMS, BAFO, PMO, OI, TOC, TSA, TCC, S-ISA, G-ISA, FTN, CW, ED, AT and OHS. I managed to learn those, but even though I did, they were often used together with not so common terms which made it difficult to follow conversations at times – especially because new terms kept being introduced.

Consequently, I cannot guarantee that I have always understood the complexities of things; I may unjustly have attributed greater meaning to certain sentences. I have taken as many precautions as possible by doing more observations, collecting more documents, conducting more interviews, but this uncertainty will still prevail to some degree. I cannot guarantee, either, that if I had done one more interview or one more observation, then things would have had to be described differently. I have done interviews and observations to the extent that I did not learn anything new, but again, because the programme relentlessly moves on without my participation, there will always be things that are left unsaid and events that I did not hear about. In an attempt to deal with this further, I did conduct interviews with

people I thought it could be interesting to speak with, but who were not directly involved. This never led to interesting findings, however, and I continued my "following the actors" tracing. By having met 79 different people who are directly involved, however, I do believe that I would have heard about more people if they had been key actors in the operation of risk management.[17]

[17] See Section 9.4 for further discussion of the limitations of this dissertation.

6. The role of risk management inscription devices in translating uncertainties into pure and impure risks

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6.1. Abstract

The processes of translating uncertainties, the potentially infinite number of unknown, into a more limited amount of manageable risks have been defined as the cornerstone of risk management, but have not been the object of many longitudinal studies so far. This paper examines a practice of risk management pertaining to the carrying out of a large public capital investment programme and sheds light, in particular, on the role and effects of risk management inscription devices. Drawing on the concepts of purification, framing and overflowing as advanced by actor-network theory, the paper shows that inscription devices, among other things, end up purifying the boundaries between which uncertainties can be included and which excluded as risks. The paper theorises the included risks to be the pure risks and the excluded risks to be the impure risks of the practice and shows that impure risks impair subsequent risk reduction. In contrast to pure risks, impure risks threaten the stability of the practice and its success in reducing all material risks. The paper contributes to current risk management literature by demonstrating the both enabling and constraining effects of inscription devices.

Keywords: uncertainty, risk management, inscription, purification, actor-network theory

6.2. Introduction

Over the last two decades, the concept of risk management has moved up on the agenda of governments and companies alike, transforming the management of organisations, including management control practices (e.g. Kaplan et al., 2009; Power, 2007). In these years, the scope of concepts such as corporate governance and accounting cannot be grasped without looking into notions of 'risk' and 'risk management' (Power, 2004; Spira & Page, 2003). These notions have been institutionalised through various guidelines, standards and frameworks (e.g. Christiansen & Koldertsova, 2009; McCrae & Balthazor, 2000; Power, 2007). Organisations ranging from private sector companies to: "…hospitals, schools, universities and many other public sector organizations, including the very highest level of central government, have all been invaded… by ideas about risk…" (Power, 2004, p. 9). In its simplest form, according to best-practice (enterprise) risk management standards, the argument goes that if an organisation is able to handle uncertain events with potential negative impacts on its objectives, this may provide reasonable assurance regarding the achievement of the organisation's objectives (See also Raz & Hillson, 2005). These standards thus promise ideals of enterprise-wide control, value production and good governance causing organisations worldwide on to implement risk management (e.g. Power, 2007).

One of the latest developments of risk management has been the fact that governments have enforced comprehensive practices of risk management onto multibillion public capital investment programmes around the world.[18] These programmes, known as mega-projects, are defined as major infrastructure programmes costing more than US$ 1 billion, or programmes that otherwise at-

[18] For more information see for example: 'HM Treasury' (2003, 2004), 'The Danish Ministry of Transport' (2006, 2008), 'Swiss Association of Road and Transportation Experts' and 'The American Planning Association' cf. Flyvbjerg (2009) and The Australian Road and State Traffic Authority' cf. Li et al., 2010.

tract public attention or political interests (Flyvbjerg et al., 2003). Such programmes have been known to incur substantial cost overruns. Over the last 70 years, these programmes have on a worldwide basis seen cost overruns averaging between 20 and 45 per cent for 9 out of 10 programmes (Flyvbjerg et al., 2002). Notable examples of this are the Channel Tunnel, the Great Belt Link or the Sydney Opera House. These programmes evolved into becoming some of the worst construction expenditure scandals in terms of budgeted vs. actual costs. As a result, governments are now enforcing risk management with the ideals of value production, good governance and enterprise-wide control onto such programmes to supplement traditional project risk management practices.

In the accounting literature, the proliferation of risk management and the translation of uncertainties into risks have not been the subject of much research. With the introduction of formalised and standardised risk management templates, Miller et al. (2008) suggest that the ability of organisations to manage the full range of uncertainties has been diminished. Power (2009) supports this when he discusses an inherent 'intellectual failure' regarding the rationality of such templates. He argues that practices of risk management constructed around them could be at worst: "the risk management of nothing". Mikes (2009, 2011) shows that systematic variations between practices exist and suggests that this indicates the co-existence of alternative cultures of risk management. Arena et al. (2010) provide further evidence for this when they attribute this divergence to different risk rationalities, experts and applied technologies. Collier & Woods (2011) argue that differences can be determined by the three contingencies of central government policy information, communication technology and organisational size. Vinnari and Skærbæk (2014) show that practices of risk management may produce its own uncertainties;

and Jordan et al. (2013) suggest that risk maps may serve as 'mediating instruments', enabling confidence-building and the resolution of different interests.

The above literature has contributed to an awareness of the potential limitations of current best-practice risk management templates and the (social) structures of risk management practices. This literature, however, has tended not to examine processes of translating uncertainties into risks 'in action' over longer periods of time, including looking into the potentially more active role and effects of risk management inscription devices.[19, 20] As a result, the current literature has ignored the effects of inscriptions for both enabling *and constraining* organisational action and thus for shaping practices of risk management. This paper contributes to the current literature by showing: (1) that some uncertainties are included as risks, while others are excluded as either uncertainties or risks depending on whether agreement on this matter exists or not; (2) that by enabling and constraining these processes, inscription devices end up purifying the boundaries between which uncertainties can be included and which excluded as risks; and (3) that the risk management frame intersects with other frames during project processes, such as the government budgeting practice, which affect the practice.

In providing evidence for these findings, this paper examines the risk management practice pertaining to the carrying out of the Danish EUR 3.2-billion public railway capital investment programme called the Signalling Programme. This programme covers the total renewal of all Danish railways signalling equipment and

[19] This paper draws on the broad definition of uncertainties as 'all the things that are unknown' and risks as the narrower and more limited amount of uncertainties which have been made manageable, the object of rational decision-making, through calculative practices (Callon et al., 2009, p. 19ff; Miller et al., 2008, footnote no. 7).

[20] An inscription device can be defined as consisting of two things: the inscription being anything having a visual display like accounting sheets; and the device being the tool that produces the inscription, such as an IT-system.

relies on an extensive risk management practice to ensure project objectives during project processes, including an expert developed and operated risk management database. The Signalling Programme is an interesting field of study because it was (and is) the first large capital investment programme in Denmark to be required by law to implement the comprehensive type of risk management described above (Transportministeriet [The Danish Ministry of Transport], 2006, 2008). This risk management approach generated debate and controversies among the participants in the investment programme about how to define the boundaries of the practice, including how to perform risk management.

The rest of this paper is structured as follows: The first section reviews the current accounting literature on risk management and inscription devices and introduces the concepts of framing, purification and overflowing as advanced by actor-network theory. The second section elaborates on our method and the data collection techniques used. The third section, our analytical section, which is divided into subsections, contains a description of the Signalling Programme, the risk management frame, the production of pure risks, the production of impure risks, the effects of the production of pure and impure risks and concludes with an epilogue. The fourth section discusses our findings in relation to three themes: the translation of uncertainties into pure and impure risks, the role and effect of risk management inscription devices, and what happens when the risk management frame meets other frames. The fifth and last section concludes the paper.

6.3. The technologies of risk management

In recent years, the accounting literature has begun discussing the limitations of what has now emerged to become worldwide best-practice risk management and its relationship with the management of uncertainty. Miller et al. (2008), for ex-

ample, suggest that current best-practice risk management templates/systems remain too focused on 'enterprise' relevant risks and has neglected what they term 'hybrid practices, processes and expertise', through which much of the actual management of uncertainty happens. They argue that the consequences of this may well be that "the ability of these systems to manage the full range of uncertainties that organizations face is diminished" (Miller et al., 2008, p. 944). In examining the conceptual level of UK's Private Finance Initiative (PFI), which postulates to improve risk management by transferring public sector risks to private sector companies, Froud (2003) arrives at similar conclusions. She argues that the rhetorical justification of PFI rests on a limited understanding of risks as 'quantifiable things that can go wrong' and thus neglects the broader notion of (unquantifiable) uncertainties, which makes PFI's success limited. Hanlon (2010) recognises the same. He further recommends that academics return to the examination of lay people's understanding of risk to advance our knowledge of this concept.

In his research on understanding the limitations of these templates, Power (2007) argues that risk management has become more about an intensification of auditing and control processes and less about "classic" operational risk reduction. This resonates well with the emergence of risk management as part of internal control sparked by the corporate financial scandals throughout the 90'es and up until now (Spira & Page, 2003). Power further suggests that the rationality of best-practice risk management with its promise of reduction of all material risks may be an 'intellectual failure' (Power, 2009). He explains that practices constructed around best-practice frameworks for those who believe to be able to take all material risks into account at worst could be "the risk management of nothing". It turns out to be more about reputational risk management (Power et al., 2009) and/or an individu-

alisation and responsibilisation project aimed at getting managers to govern themselves (Power, 2013).

The accounting literature has also looked into structures of risk management practices and suggested that the transition from the world of templates to the world of practical realities has made risk management fluid and disparate. Arena et al. (2010) conclude that this can be explained by different risk rationalities clashing during the implementation of risk management between experts using technologies to shape these practices. Woods (2009) and Collier & Woods (2011) examine cross-national public risk management practices and argue that practices can be explained/determined by, but not limited to, three contingencies: central government policy information, communication technology and organisational size. Another contribution to the literature is made by Mikes (2009, 2011) and her seven case studies of banking risk management practices. Mikes shows that the differences can be explained with reference to alternative logics of calculation, which she conceptualises as different 'calculative cultures'. Some organisations have a culture of "quantitative enthusiasm" dedicated to risk measurement and modelling, while others have a culture of quantitative scepticism where risk values are regarded as trend indicators. In order to explain these dynamics, risk experts further engage in boundary work to expand and sometimes to limit such practices, this boundary-work being "contingent on the calculative culture they display" (Mikes, 2011, p. 241).

The above literature has contributed to an awareness of the potential limitations of current best-practice risk management templates and to the structures that may explain the variations between practices of risk management. In doing so, the current literature has focused less on the force of inscription devices for mobilising the

boundaries of risk management and the effects those devices have on the processes of risk management. These inscription devices have been shown elsewhere in the accounting literature to be important (e.g. Chua, 1995; Qu & Cooper, 2011; Quattrone, 2009; Quattrone & Hopper, 2006; Robson, 1992; Skærbæk & Tryggestad, 2010). Chua (1995), for example, shows how expert-generated inscriptions produced faith which allowed for accounting changes to come about; Skærbæk & Tryggestad (2010) show how accounting tools such as the pay-back method can actively participate in forming of the strategy to be decided upon; and Qu & Cooper (2011) show how inscriptions can complement and serve the needs of humans but are not always able to produce the intended effects. This perspective, however, has not been applied in the risk management literature, so examining this may expand our understanding of risk management practices and add to our knowledge of the effects of inscription devices in general.

The current risk management literature, however, has shown that practices of risk management have become highly technological. Collier & Woods (2011) illustrate the importance of communication technologies for enabling practices across different countries; Arena et al. (2010) and Mikes (2009, 2011), as previously mentioned, show how different risk management experts draw upon technologies in order to construct practices; Winch (2010), focusing on project management of large investment programmes, argues that risk management devices have moved to 'the heart of doing risk management'; and Jordan et al. (2013), drawing on Miller & O'Leary's (2007) notion of "mediating instruments", find that technologies enable distributed actors to resolve different interests and build confidence with the project and its progress over time. In combination, however, these studies do not look into the more active role and effects of inscription devices and how they may create controversies, that is, how they may produce their own overflows,

which may constrain the very practice they set out to enable. In this respect, the above studies are consistent with the early literature on accounting inscriptions which did not grant inscriptions an active role (Busco & Quattrone, forthcoming).

The current literature also tends to be limited to the study of risk management within formal organisational boundaries and not crossing such boundaries to follow the actual actors involved, i.e. the hybrid practices of risk management described by Miller et al. (2008). If we examine practices of risk management related to public sector organisations such as those that manage capital investment programmes, trespassing boundaries becomes paramount. Such organisations are affected by numerous actors such as ministries, politicians and consultancies, who may all in some way influence the organisations' way of practising risk management. If we limit ourselves in advance, through the design of our studies, from crossing organisational boundaries, we risk missing out on important events, actions or actors. Consequently, we cannot fully agree with Mikes (2009, p. 19) that we have to look: "behind the scenes of risk management to its actual organizational setting", because we also have to cross those boundaries and look into specific associations between the actors involved. Vinnari and Skærbæk (2014) even advise future research to study this in more detail because, as they demonstrate, risk management practices may possibly produce its own uncertainties. In addition, other scholars are calling for more research into risk management practices (e.g. Bhimani, 2009; Gephart et al., 2009; Miller et al., 2008; Van der Stede, 2011).

6.4. Actor-network theory and risk management

In analysing the processes of risk management, including the role and effects of inscription devices, this paper draws upon the concepts of framing, overflowing and purification as advanced by actor-network theory (Callon, 1998a; Callon et

al., 2009; Latour, 1993).[21] As we understand these three concepts, they all emerge from the broader notion of translation, which can be defined as the process of: "… displacement, drift, invention, mediation, the creation of a link that did not exist before and that to some degree modifies the original two" (Latour, 1999b, p. 179). This implies a non-linear development and a dynamic process of "displacement and transformation" in which stabilised associations represent rare and always temporary achievements (Callon, 1986). In re-presenting the work on translation, the concept of framing refers to the organisation and guidance of associations in order to: "…establish a boundary within which interactions… take place more or less independently of their surrounding context" (Callon, 1998a, p. 249). This process depends on commitment by human actors, but also on material arrangements such as, precisely, inscription devices.

The concept of framing makes little sense without that of overflowing, which refers to all the possible things that can go wrong; all the potential associating work between actors not contained within the frame (Callon, 1998a, p. 252). In this respect, all things can never be contained within one frame at all times, so overflowing also directs attention to the fact that an all-embracing frame can never be achieved. To Callon, overflowing represents the norm and framing the exception that it requires substantial investments to both establish and maintain over longer periods of time (See Callon, 1998a). In relation to studying the processes of risk management, framing and overflowing thus direct attention to the transformative and often unexpected effects that humans and non-humans can assume in co-producing risks. In relation to the role and effects of inscription devices more spe-

[21] Some years after Pentland's (1993) seminal work of how audits produce comfort and purity, theoretical interest in purification has proliferated (See: Christensen & Skærbæk, 2010; Gendron et al., 2013; Young, 2014).

cifically, these concepts emphasise the dual notion of both enabling and constraining processes of producing risks.

The concept of purification adds to those of framing and overflowing by referring to the *active* processes of turning ideas or things that were once controversial or devalued into acceptable and *unchallenged* constructions or "facts" (Latour, 1993). The concept of overflowing, however, implies that "facts" are facts only to the extent that they can always be contested and refuted. This was expanded upon by Latour (1993), who rejected the modernist conception of the distinction between nature (the pure) and society and its dirty politics (the impure) and argued that even "hard facts", pure facts, represented constructions. To illustrate this, Christensen & Skærbæk (2010, p. 524) used purification to explain how consultancy companies with their "scientific equipment", albeit only provisionally, became involved with translations to: "… provide faith to accounting systems and to settle controversies with sceptical and resisting groups that threatened to destabilize the innovations". This paper uses the concept of purification to shed light on the possible purifying role and effects of risk management inscription devices on the processes of translating potentially disputed uncertainties into well-defined, accepted and manageable risks, e.g. into fact-like risks. In other words, we suggest that inscription devices can be more active mediators in the processes of translating uncertainties into risks than has been recognised by earlier risk management literature.

In an extension of the literature on purification, this paper also emphasises the effects of the processes of translating uncertainties into risks, that is the "product" and its consequences, or what we in the context of risk management term the production of pure and impure risks. The concept of pure risks refers to those uncer-

tainties that have been accepted as risks and included into the practice of risk management; and the concept of impure risks refers to those uncertainties that have been proposed as risks by some actors but due to disagreement have been rejected from the practice of risk management. It is important to emphasise that pure and impure risks are relational constructs, which means that the same risk can be constructed as pure for someone at one time and then later found impure for someone at another time, and vice versa. The distinction between pure and impure risks, however, refers to more than an analytical distinction. It is important to recognise that whether a risk has been included in the practice as pure or excluded from it as impure lead to different empirical effects. It is also important to recognize that pure/impure risks must be distinguished from uncertainties as the former denotes those elements that have been taken into account and the latter those that have not and thus remain unknown at least for the majority of the people involved.

In drawing on the concepts of purification, framing and overflowing, we anticipate to find that the expert-operated risk management inscription devices will guide the possible uncertainties considered as risks because these devices creating categories, steps and criteria which frame the practice. When applied, these inscription devices will fixate the 'possible states of the world' and thus establish boundaries between what can be included into and excluded from the practice as manageable and agreed-upon risks. If project managers, for example, propose something on their own, define their own 'state of the world', e.g. their own risk, their proposal may not be included if not accepted by the expert devices. This does not mean, however, that the programme might not benefit from the effects of the proposed practice, or that actors other than devices are without importance, so we need to take the effects of the practice into account. Overall, we are guided by the follow-

ing questions: how are uncertainties translated into manageable risks, and what are the role and effects of inscription devices?

6.5. Method

In accordance with actor-network theory methodology, we continue along the path of "telling interesting stories" (Law, 2009), which means that we draw upon case studies, or rather one case study, as our method. In defining case studies, they can be understood as in-depth and detailed descriptions of real-life situations, which make up "good" descriptions (Latour, 2005, p. 137). We have decided to use this method because it allows us to trace the hybrid processes of actual risk management, including the role and effects of inscription devices. In the words of Latour (1996), it allows us to describe "the generative path of any narration", and thus to track the associating work of actors across formal organisational boundaries: "… to catch up with their often wild innovations" (Latour, 2005, p. 12). The authors have examined the Signalling Programme 'in action' from late 2009 until 2012 and gathered documents dating back to the late 90'es, when talks about risk management emerged within the Danish public sector. The period of late 2009 to 2012 corresponds approx. to the two first phases of the Signalling Programme: the conceptual project definition phase and the procurement phase.

The paper relies on a collection of documents, observation studies and semi-structured interviews as the main empirical sources to inform our study. In the course of the period under study, the first author collected several hundreds of pages of written documents pertaining to both the overall investment programme and the risk management practice. The material includes an examination of the content of the risk database, which contains all information of the agreed-upon and accepted risks. These documents have provided background information on the

programme, more detailed information on the construction of the risk management practice, and information about actual risks. This empirical source enabled us to reconstruct the actions and events that make up the programme and to get an understanding of the risks included in the practice, e.g. the pure risks of the practice. It should be noted that the first author also attended conference presentations, participated in informal chats, and had several informal conversations and an extensive email correspondence with several actors.

In examining the translating of uncertainties into risks, however, documents alone do not illustrate what takes place *during* the translation process, and consequently the first author also made observation studies over the last three years. The observations allowed us to follow the actors 'in action' (Latour, 2005, p. 128) while the participants were constructing the actual risks and to show the controversies that arose out of the process. The observation studies were carried out at operational risk meetings, cross-risk review meetings and risk workshops, which were where all formal risk identifications and assessments were made. The first author also planned to carry out observations of everyday work practices among the project managers; this was dropped, however, as it produced very few relevant observations, as project managers spend very little time on risk-related work duties compared with other duties. The observation studies were organised as non-participant studies, which means that the first author stayed in the background and never interfered with the on-going interaction. Instead, the first author took more than 300 pages of extensive field notes, which were subsequently transcribed to make sure that as little as possible was forgotten. At the formal meetings and workshops, more than 50 different risk owners were observed assessing or reassessing approx. 440 uncertainties as pure risks and approx. 120 uncertainties as impure risks. The

observation studies also provided insight into the construction of a large number of risk reducing actions.

Our third and last data collection technique was to conduct 15 interviews with different actors involved in risk management, including risk consultants, a number of project managers, programme management and various stakeholders. The first author conducted these at different intervals in the course of the examined period. The interviews were semi-structured, meaning that we used an interview-guide to structure our initial questioning while still remaining open to whatever direction in which the interviewees wanted to bring the conversation. This allowed the interviewees to provide their own accounts of whatever they found relevant and interesting, without straying too far away from the subject of risk management. As the interviews were not limited to any predefined length, the interviewees further had time to communicate their own understandings of risk management and to follow their own ideas, express their own frustrations etc. for as long as they wanted. Each interview lasted from one to two hours and was recorded and transcribed. In addition, it was explained to each interviewee that they would receive the transcript afterwards to allow them to could validate the content. This allowed us to formulate follow-up questions, which we did on several occasions. It was also explained to each interviewee that if they were going to be quoted, their contribution would be anonymised to prevent them from being recognised.

The three techniques allowed us to trace the mediating human and non-human actors that circulated the practice of risk management and to cross-validate our findings (Latour, 2005, p. 129). The actors were neither preselected nor predefined when we began the examination, but were identified on the basis of our network-tracing activity to include only those actors that did something, the mediators. This

includes both human actors, such as the project managers, and non-human actors (Callon, 1998a, p. 255), such as the risk database. This made it possible for us as observers to seek to remain faithful to the actor-network-theory methodological principles of: agnosticism, that we as analysts should remain impartial; generalised symmetry, that in case of conflicting viewpoints we explain them in the same terms, i.e. that we do not only repeat the interviewees' own interpretations, but choose interpretations that will hopefully convince the reader; and free associations, that the social world is not privileged over nature and the material world (Callon, 1986, pp. 200-201). In accordance with these principles, we sought to impose neither our own interpretation nor our own "analytical grid" before listening to the actors: We have listened to the actors first and not privileged any viewpoints, and then together with the other sources reconstructed actions and events as they unfolded.

6.6. The translation of uncertainties into risks

6.6.1. The Signalling Programme

In the beginning of 2009, The Signalling Programme came into being as the Danish Parliament decided to fund a EUR 3.2-billion programme of renewing all Danish railway signalling before the year 2020/21 (Banedanmark, 2009a). This included replacing all signalling equipment from basic train detection and point machines to overall traffic management systems. As the government-owned organisation managing railways infrastructure in general, Rail Net Denmark was given the responsibility of implementing this programme. The Danish railway network includes 2100 km of lines and 3200 km of tracks and serves about 560 train sets and locomotives from four major operators on the conventional network. The green light was given because the Danish signalling system had aged to the

point where many of the existing signalling systems had exceeded their technical service lifetime. The existing signalling systems caused approx. 39,000 train delays per year and accounted for about half of all delays. It was thus responsible for a considerable deterioration of the overall train traffic service level, which meant that it was imperative for the government to take action (Banedanmark, 2009a).

The Signalling Programme employs about 120 persons of whom about one-third are full time employees and two-thirds are external consultants, but the manpower turnover varies as the programme progresses over time (Banedanmark, 2008a). The Programme has been set up as its own division within Rail Net Denmark and is divided into five major subprojects: F-banen, S-banen, Operational Rules, Civil Works and Related Projects (see Appendix 2). The conventional / regional network (F-banen) and the mass transit system (S-banen) projects are the objects of the implementation of the signalling equipment and are the two largest subprojects. The Operational Rules subproject handles the development of new safety and regulation documents needed for getting approvals for changing the signalling system; the Civil Works subproject manages the construction of the required infrastructure, including two new traffic control centres; and Related Projects manages all other subprojects, of which the On-board subproject and the GSM subproject are the largest. The On-board subproject manages the replacement of all on-board equipment for mainline trains and thus supports the F-bane subproject, and the GSM subproject manages the implementation of a new radio and data communication technology. The Signalling Programme has further been divided into five project phases: conceptual, procurement, design, testing and roll-out (see Appendix 3 for an overview of the timetable of the programme, however excluding the conceptual phase as the timetable was produced at the end of this phase).

One of the government's requirements for approving the programme was the implementation of risk management with its ideals of enterprise-wide control, value production and good governance (Transportministeriet, 2006, 2008). On several occasions, Rail Net Denmark had been criticised for its recurring management accounting problems (Rigsrevisionen [National Audit Office of Denmark], 2002, 2004, 2005) [22], and worldwide large capital investment programmes were known to incur huge cost overruns. The Danish Ministry of Finance wanted to avoid this from happening and therefore enforced "best-practice" risk management inspired by private sector developments (Finansministeriet, 2010). The Signalling Programme became the first programme in Denmark to attempt implementation subjected to this legislation (Booz Allen Hamilton, 2006a). The Signalling Programme, the Danish Ministry of Transport and the Ministry of Finance, however, knew little of how to approach the implementation. The Signalling Programme, after due processes, therefore contracted Ramboll A/S (Denmark), Emch+Berger Group AG (Switzerland) and R+R Burger und Partner AG (Switzerland), whom had formed a consultancy conglomerate (Banedanmark, 2008a). This conglomerate recommended implementing the worldwide best-practice project management framework PMBOK's section on risk management (PMI, 2004). The following section describes how this framework framed the construction of the practice.

6.6.2. The Signalling Programme's risk management frame

The Signalling Programme's risk management practice has been designed around several PMBOK-inspired documents which frame the purpose of the practice, the roles of the actors, and when, where and how risk management should be conducted. To begin, the overall objectives are stated as follows: "...to increase the proba-

[22] See also Justesen & Skærbæk, 2010, who demonstrate how accounting problems went beyond Rail Net Denmark to many of the public agencies / state owned enterprise under the auspice of the Danish Ministry of Transport, who further themselves were under strong critique from the National Audit Office of Denmark.

bility and impact of positive events, and decrease the probability and impact of events adverse to the project" (Banedanmark, 2007, p. 1). To be able to achieve this, the risk consultants (about five persons) have been appointed as the managers or the risk experts of the practice. The consultants are responsible for the successful outcome of the practice, which primarily includes producing risk agendas, organizing risk meetings and producing risk status reports. The consultants further participate in all risk meetings, operate the risk database, instruct all newcomers and correct experienced actors to make sure that all uncertainties are turned into manageable risks the exact same way.

The formal documents also include the programme's project managers as the risk owners, meaning that they are responsible for participating in all risk meetings and for identifying, assessing and reducing all risks (Banedanmark, 2007, p. 19). The project managers are the largest group of actors and number more than 50 persons, although this number changes through the programme's lifecycle, depending on the subproject. The documents also identify programme management, which is the programme director, the programme manager and the head of secretariat, as risk owners when identified risks concern overall programme level risks. In this respect, the programme management also have to approve any prepared risk status reports, and thus, together with the (senior) risk consultants, have been framed as the strategic centre of the practice. Last but not least, the documents also include a definition of various stakeholders as risk specialists of the practice, such as financial controllers, safety managers, suppliers and train operating companies etc. They are often invited by the risk consultants to participate in meetings (especially workshops) to provide input on relevant risks.

In the organisation of the practice, the processes of risk management have been framed around the following four major steps: risk identification, risk assessment (qualitative and quantitative), risk response planning, and risk monitoring and control. The risk identification step involves "...determining which risks might affect the project and documenting their characteristics" (Banedanmark, 2007, p. 1). The risk assessment step involves "…prioritizing risks for subsequent further analysis or action by assessing and combining their probability of occurrence and impact… [and]… numerically analysing the effect on overall objectives of identified risks" (Banedanmark, 2007, p. 1). The risk response planning step involves "...developing options and actions to enhance opportunities, and to reduce threats to project objectives" (Banedanmark, 2007, p. 1); and the fourth and last step, the risk monitoring and control step, involves "...tracking identified risks, monitoring residual risks, identifying new risks, executing risk response plans, and evaluating their effectiveness throughout the project life cycle" (Banedanmark, 2007, p. 2). These processes are described by the formal documents as iterative and should be conducted throughout the lifecycle of the programme.

In order to assist the risk consultants' management of the practice and its processes, the consultants have developed a risk database with a risk database management tool (in the following just called the database). The database has been developed to serve the main purpose of registering and organising all identified and assessed risks. In addition, the consultants can use the database to provide overviews of risks owned by specific actors or across specific subprojects and thus produce status reports, calculate risk values, and keep track of risk owners and their risk-reducing actions. In allowing for this, the database has been designed around a "meta-language risk description method", which requires that the involved actors describe risks as follows: "As a result of <definite cause>, <uncer-

tain event/risk> may occur, which would lead to <effect on our objectives>" (Banedanmark, 2007, p. 6). The database has also been designed around a "traffic light assessment matrix", which is a 5x5 risk rating matrix that allows for the assessment, visualisation and grading of risks into low (green), moderate (yellow) and high (red) boxes (see Appendix 4). The risk owners are required to assess identified risks using this matrix related to five cost, time and/or punctuality impact categories x five probability interval categories (see Appendix 5). The consultants require that the risk owners, using their best judgment, follow these prescriptions if risks are to be added into the database and thus included into the practice (Banedanmark, 2007, p. 4ff).

The database has been designed to encompass the entire framework of the practice, including the processes of risk management. 'Figure 6.1' shows the main risk window of the database, which all participants can observe at all risk meetings. In the upper left part of the screenshot, the database requires that the involved actors identify new risks according to the "meta-language risk description method". If we look to the left, centre and upper-right of the screenshot, we can see where the actors have to fill in their assessment of the risks using the categories and logics of the "traffic light assessment matrix", including documenting and categorising the risks they propose as well as describing and selecting risk owners. In the bottom left-hand part of the screen, the actors fill in information on risk response planning; and lastly, the "menu options" to the right illustrate the options that the risk consultants have for risk monitoring and control. Overall, the database thus becomes the centre of calculation.

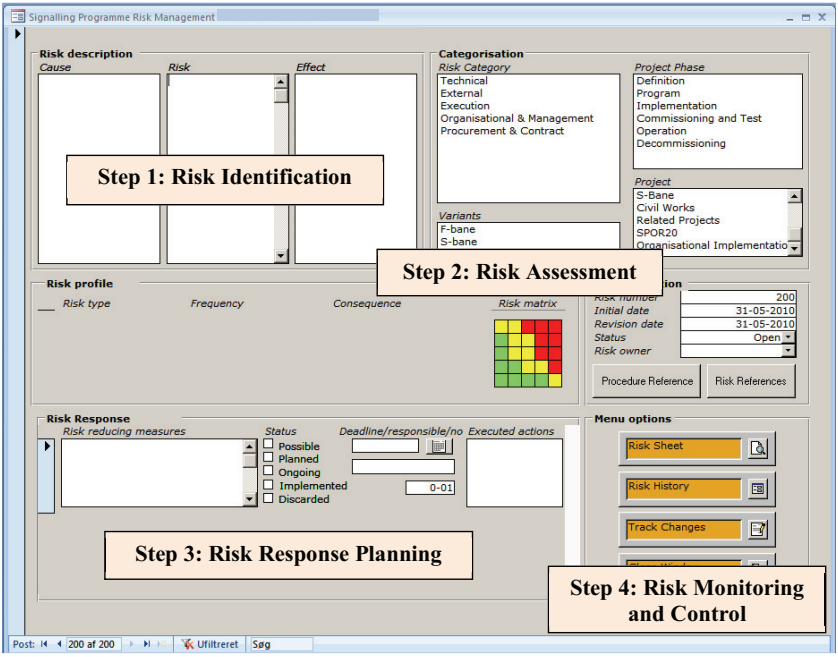

Figure 6.1: Risk management database screenshot, main risk window

The risk management practice consists of three types of meetings: operational risk meetings, cross-review risk meetings and risk workshops. The first, operational risk meetings, are held approx. six times a year per subproject between one or more risk consultants and one or more project managers from the subproject in question. These meetings focus on the identification and assessment of risks related to individual subprojects that affect the objectives of the programme. The second type of meeting, cross-review risk meetings, are held approx. four times a year between one or more risk consultants, the head project managers across different subprojects, and members of programme management. These meetings focus on the major risks across subprojects before the production of status reports

showing the highest ranking risks threatening the objectives of the programme. The third and last type of meeting, risk workshops, are held whenever major events have taken place for which the involved actors want to assess the new risk situation. The participants are one or more risk consultants, and, depending on the situation, project managers, stakeholders and/or programme management. All types of meeting are framed by the invitations produced by the risk consultants. These invitations indicate: the invited (and thus uninvited) actors, the time, duration and location of the meeting and, often, the required minimum amount of risks to be taken into account.

This section has shown how the practice of risk management has been framed and how the database has been designed as the prime risk management device to facilitate the process of translating uncertainties into risks. The risk consultants equipped with the database have furthermore designated themselves as the experts of the practice, and because they organise and participate in the risk meetings they are able to ensure that the other participants follow the requirements of the constructed and framed practice. The scene has thus been set for an examination of the processes of translating uncertainty into what we term the pure and impure risks of the practice, including the role and effects of such devices as the risk database.

6.6.3. The production of pure risks

The process of producing risks takes place in the above-mentioned risk meetings and begins with the re-identification and re-description of the risks on the agenda followed by the participants' proposals of new risks. In this identification process, the participants always attempt to adhere to the "meta-language risk description method". The observation studies show that out of the more than 560 translations

observed, the approx. 440 included risks have been identified by participants adhering to this method. The following exchange is representative of the approx. 440 conversations that ended with the risk being included and illustrates the process of identifying new risks as it takes place across risk meeting types. The exchange took place at an operational risk meeting for the Operational Rules subproject. Prior to the meeting, the risk consultant participating had invited the head project manager and one of his experienced railway operations and management consultants. The following exchange takes place towards the end of the meeting after the three participants have reassessed the risks on the agenda:

> *""I have a new risk I would like to include", the subproject's consultant said. "Interesting, please go ahead", the risk consultant responded. The subproject's consultant began to explain that the train operating companies (TOCs) were responsible for making the operational guidelines for their train drivers. He continued and said that they should add the risk that these companies would not have the guidelines completed at the time of the deployment of the signalling system. He explained that this meant that the train drivers would not be able to interpret the signalling system information and hence not be able to operate the trains, which would cause all train traffic in Denmark to break down. "So this is just stakeholder management", the risk consultant stated and recorded what the subproject's consultant had said into the risk database's 'risk description' field. "Ah yes, you can say that", the head project manager interjected, smiling. "But the situation is much more complex than just 'stakeholder management'", he added. He explained that the problem was that the TOCs were not willing to do anything*

about it and also that the Signalling Programme, not to mention the subproject itself, had no authority to force them to do so. He continued and explained that only the Danish National Safety Authority (NSA) could force the TOCs to do something about it – and they had done nothing about it so far… The risk consultant, who had been entering something into the risk database's 'risk cause' field, now asked the other two if they could agree to this. On the projector screen the following could be seen: "TOCs are responsible for issuing and getting approval of the operational rules for their staff". The head project manager and the subproject's consultant both replied that they agreed with this. The subproject's consultant interjected, however, that he would like the risk consultant to add a "however" to the sentence as he did not feel the description captured the complexity of the discussion. The risk consultant asked him what he meant by that. The subproject's consultant told him to write the following: "TOCs are responsible for issuing and getting approval of the operational rules for their staff; however, these rules must be ready before early deployment scheme". The risk consultant wrote the new sentence down. He also wrote the effects of the risk into the 'risk effect' field of the database: "Delays and increased costs". The others did not comment on that". (O3, 4-8)

The above exchange illustrates how the participants follow the "meta-language risk description method" when identifying risks: the participants always begin with something uncertain, something still open to definition, but through the process they end up describing something well-defined and manageable. In the ex-

change, the actors began their discussion with what the uncertainty was about (TOCs not preparing guidelines on time), how to understand the *cause* of this (TOCs not willing to do this) and the *effects* of this (TOCs causing all train traffic to break down). In the process of writing down the definition, however, the risk consultant only wrote those aspects down that fitted the method. He did not capture all the discussions, the intrinsic complexities, the disagreements, just what fitted the cause, risk title and effect fields of the database, which was three sentences. In this example, the discussion about whether this "just" related to stakeholder management was left out, and the potential traffic breakdown effect was reduced to mere "delays and increased costs".

The observation studies show that assessing the probabilities and impacts of risks are also considered by the participants before uncertainties are included as risks and recorded in the database; the above-mentioned approx. 440 included risks all contain assessments. In this process, the participants all exhibit their best judgments when conducting risk assessment and adhere to the "traffic light risk assessment matrix" and its assessment categories. The participants all attempt to assess the proposed risks against the five impact assessment categories of time and cost impact and the five probability assessment categories of percentage intervals. If disagreements emerge, the consultants, like before, settle such disagreements by referring to the database and shaping them according to the requirements of the practice. The following exchange shows what happened right after the participants from before "completed" their identification:

> *... "So let us move to the risk assessment", the risk consultant said and moved the mouse cursor down to the risk assessment categories and selected the categories: 'cost f-banen', 'time f-banen',*

'cost s-banen' and 'time s-banen'. The others did not comment, but looked to the end of the wall with the projector screen. "So how can we assess the risk", the risk consultant asked. The subproject's consultant answered by saying that for 'time s-banen' and 'cost s-banen' the 'probability' should be set to 'highly likely' (20 to 65 per cent). If the TOCs had not finalised the guidelines before the following year, he explained, this would delay the deployment of the signalling system on s-banen. He explained that the deployment on s-banen was scheduled to begin at the start of next year. He also noted that this would not only cause delays but also additional costs as the programme could end up being put on standby until the TOCs completed their guidelines. The risk consultant selected the 'highly likely'-box from the 'probability' risk categories related to 'time s-banen' and 'cost s-banen'. The subproject's consultant continued: "For f-banen, we will have another year before early deployment scheme, so I think we should select the 'probability' to be 'likely' (5 to 20 per cent) for 'time f-banen' and 'cost f-banen'". "And are you sure about that", the risk consultant asked with scepticism in his voice. "Yes, this is one of our major risks", the risk consultant replied. The risk consultant checked the 'likely'-box from the 'probability' categories related to 'time f-banen' and 'cost f-banen'... Okay, so what can we say about the 'consequence' of the risk", the risk consultant asked. "Is it 'high' for both s-banen (time and cost) and f-banen (time or cost) or what do you think?" he asked... The subproject's risk consultant and the head project manager began to discuss this. The subproject's consultant said that he thought the 'consequence' for 'time s-banen' and 'cost s-

banen' should be set to 'high' and the 'consequence' for 'time f-banen' and 'cost f-banen' should be set to 'moderate'. The head project manager agreed. The risk consultant, however, kept on asking them if they were sure about that. The participants began to discuss this. In the end, the subproject's consultant and the head project manager agreed to lower the assessment of all 'consequences' to 'moderate' with the exception of 'time s-banen' where 'high' was selected. The risk consultant made all the adjustments to the database and said that the risk for 'time s-banen' was now assessed as 'red' (3, 4) and the others as 'yellow' (3, 3), referring to the traffic light matrix with the mouse cursor. The participants could observe the mouse cursor and the plotting on the projector screen". (O3, 9-12)

The exchange shows how the actors followed the 'traffic light assessment matrix' and assessed the risk according to the five different cost and time impact categories and the five different probability percentage interval categories. In this exchange, the participating risk consultant selected the categories *before* asking the participants to do the assessment without getting any reaction from them, which shows that they did not disagree with the approach taken. The participants did discuss whether the risk had to be assessed as "high" or "moderate", and they did have lengthy discussions about this, but they never once discussed the relevance of the categories themselves. The participating risk consultant in charge of the database thus limited the many ways the assessment could have been conducted. The risk consultant further entered their assessment into the database by marking the categories suggested by the participants, and the participants could all observe the visualisation of this on the projector screen.

The observation studies show how the following more formal information is also produced before risks are included: which project phases, categories, variants and subprojects the risks relate to, the current status of the risk, and who owns the risks. The approx. 440 included risks have all been designed with this information, which the risk consultants have recorded in the database without giving cause to much discussion. In 'Figure 1', this information represents the "categorisation" and "documentation" fields besides the information on risk number, initial date and revision date, which the database fills in automatically whenever "new" risks are added or "old" risks revisited. Sometimes, however, discussions emerge as to who should be the owner of the risk, as some actors do not feel comfortable being responsible for something they feel they cannot do anything about. The exchange from before can be continued to illustrate this, which also wraps up the construction of that risk:

> *"…The risk consultant notes down the subproject's consultant and the head project managers as risk owners. He asks them what they think of this. The subproject's consultant disagrees. He says he believes the project managers from the two major subprojects (f-banen and s-banen) should be responsible. He explains that the operational rules subproject people have done what they can – without any luck – and that if more pressure should be put on the TOC, this should come from s-banen's and f-banen's project managers. The risk consultant says he understands but also insists on keeping the head project manager as owner in order to ensure that proper attention will be given to the risk. The subproject's consult-*

ant and the head project manager agree, and they decide to move on". (O3, 12)

In summary, this section has shown how approx. 440 out of 560 observed risks being constructed have been designed by participants following the "meta-language risk description method" and the "traffic light assessment matrix" and other more formal information. If any disagreement or controversies emerged about how to describe and assess risks, the risk consultants settled these with reference to the structure of the database. The consultants further excluded disagreements and controversies from the database when entering the proposed risk-related information, that is, the included risks were purified by the consultants equipped with the risk database, which as an outcome made these risks look like "facts". The risk consultants in charge of the database purified the practice of translating uncertainties into risks by reducing the potentially infinite number of ways the translation could have been done. In short, these included risks have now been made manageable and reducible to the practice and they have come to represent what we term the pure risks of the practice.[23]

6.6.4. The production of impure risks

The inscriptions produced from the database, that is, the formal documents produced from the practice to illustrate its progress, give the impression that all proposed and relevant risks have been included without controversies. The observation studies, however, show that approx. 120 out of 560 produced risks end up being rejected despite having been found relevant by the actor(s) proposing them. The observation studies further show that approx. 100 out of 120 rejected risks are

[23] It should be mentioned that risks can be included despite disagreement; however, this only happens if the disagreement exists between other participants than the risk consultants or programme management.

rejected in strong disagreement. The following section looks into how this happens by giving three examples of exchanges illustrating how uncertainties proposed as risks end up being contested, rejected and considered impure for the practice.

As the previous section showed, the participants must describe the cause-and-effect relation between the proposed uncertain event and the programme's objectives in order for the uncertain event to be included as a (pure) risk. The *first* exchange shows how an uncertain event with a potential negative effect on the objectives of *other* entities was excluded despite the proposing actor's argument that it had effects on the Signalling Programme's objectives. We enter the exchange immediately after the project manager has suggested that the signalling system might affect small private train operating companies' communication abilities and, ultimately, their survival:

> *""What do you mean", the risk consultant operating the database asks. The project manager explains that the new signalling system requires that the operators invest in proper train communication hardware. He continues and explains that the small operators might not have the necessary capital to make the investment and thus not be able to operate. "They will not survive", he states. The risk consultant replies that this situation relates to the operators' objectives. "It's out of scope and irrelevant for us", he adds and explains the purpose of the practice using the mouse cursor to demonstrate the cause, risk and effect fields. The project manager looks frustrated and gazes around the table. The others look down and seem to ignore him. The project manager adds that if the train*

operating companies do not survive, this may turn out to be a problem for the people using trains to commute to and from work. He says this might all turn out as one big media scandal which may threaten the programme. The risk consultant says he knows nothing about that and ends the discussion. They move on". (O2, 18)

This exchange illustrates how the proposed risk of small train operators not being able to survive was rejected, found impure, for the practice because the risk was: "… out of scope and irrelevant for the practice". The exchange also illustrates that this happened because the consultant, equipped with the database, the projector and the mouse, visually could show the project manager that his proposed risk did not fit the categories of the database. It follows from the ways the practice has been framed that cause-and-effects had to be directed at the objectives of the Signalling Programme – and not small train operators. The risk consultant could now make this argument by moving the mouse cursor to the fields and visually show the project manager that these fields had to be filled in. As the project manager could not provide this information (because his risk did not have direct effects on the Signalling Programme), this meant that the risk was rejected as such. The risk was still seen as a risk by the project manager proposing it, however, but that mattered little as he could not argue "against the system". Other exchanges illustrate similar findings (e.g. O28, 8).

As the previous section also showed, the processes of translating uncertainties into risks also includes the assessment of risks according to the 'traffic light assessment matrix' with its assessment categories of time and cost. The *second* exchange shows how proposed risks related to effects on something different than time and/or cost categories are not included and found impure because they do not fit

into that matrix. At the beginning of the programme, the risk consultants held an operational risk meeting with the project managers and the financial controller from one of the larger subprojects. The following exchange takes place during the assessment of one of the risks on the agenda for that meeting and relates to not having sufficient resources to complete the contract negotiation phase of the subproject:

> *"The financial controller interrupts the assessment and asks why they do not assess the effects of this risk on the quality of the programme. If they lack the resources to complete the contract negotiation phase, the controller states, this has to affect the quality of the signalling system. The controller says she knows this is her first meeting but suggests they add another risk concerning this issue. Almost before anyone has time to react, one of the risk consultants replies by saying that: "...one cannot assess risks according to anything else but the categories included in the database" showing her these categories with the mouse cursor on the project screen. The controller looks surprised but does not respond to this statement. The remaining four participants did not comment on the situation, and the two consultants pressed for the meeting to continue". (O1, 17)*

The above exchange illustrates how the risk consultant in charge of the database and its entanglement with the 'traffic light assessment matrix' rejected the assessment of a risk that related to anything else but time and cost categories. In this exchange, the risk consultant in charge of the database left the proposition whether the lack of resources could affect the final quality of the programme as irrelevant,

as impure, for the practice. The other participants did not enter this discussion, and the meeting went on leaving the controller baffled at having her proposition rejected without at least a discussion. Other exchanges serve as similar illustrations of how also proposed risks with effects on later 'operations' and/or 'maintenance' of the new signalling system are not included (e.g. O8, 16; O23, 9).

The *third* exchange illustrates how proposed risks related to day-to-day operations are rejected as risks for the practice (the term was coined by project managers) despite the finding that the participants suggesting them disagree. At the beginning of 2012, the risk consultants called a risk workshop on behalf of the head project manager of a newly merged subproject between two communications related subprojects. The workshop had eight participants, including one risk consultant, two external consultants employed with the subproject and five project managers from the subproject. The following exchange takes place after the participants have brainstormed on all possible risks and during the subsequent presentation of their results:

> *"The risk consultant gives the floor to [a] project manager and asks her to describe one of the risks she identified. The project manager explains that she cannot extend the employment period of key personnel on termed employment contracts more than twice within six months. She continues and explains that because of this they risk losing the knowledge of these people when their contracts terminate within the next two months. If this happens, she says, new employees may have to spend weeks catching up on that lost knowledge. She suggests they add this risk to the database. The risk consultant rejects her proposition. "It's too local, too small and*

too specific for your project to include", he says. "It's not relevant for the overall programme. It relates to day-to-day operations", he adds while stressing several times that she should handle this herself. The project manager looks frustrated and tries with other arguments to persuade him, but the risk consultant refers to the purpose of the practice: to assess risks relevant for the programme and not subprojects. After several minutes discussing this, they move on, the risk having been rejected". (O15, 33)

This exchange illustrates how risks related to day-to-day operations of subprojects are rejected because they are "not relevant for the overall programme" and thus a matter that the project managers should deal with on their own. These "types" of impure risks often come up at meetings but are always rejected with the same explanation about being "too local, too small and too specific" for the programme. In this exchange, the project manager argued for including the risk of losing irreplaceable knowledge because of not being able to extend the contract of some of her key employees. The project manager did not find the proposed risk "too local, small or specific"; this proposed risk was "real" for her and not something to be rejected; this situation had to be dealt with. The conversation, however, ended with the project manager having to accept that this could not be included and approved of as a risk.

Some impure risks are later translated (back) into pure risks. The observation studies show that this has little to do with the "type" of impure risk proposed and more to do with the actors' ability to change their description of the risk into something the practice can accept (O15, 34; O28, 8). The following abbreviated exchange has been taken from the above-mentioned workshop, where the project manager had

to accept the rejection of her proposed risk of losing employee knowledge. A few minutes later, another participant came to her support by arguing for more widespread consequences than "just" day-to-day operations:

> *""Can I add that I face this problem as well? I also think the effects are more widespread than just for our day-to-day operations". The risk consultant asks him to elaborate. The project manager argues that because many people find themselves in this situation, the entire subproject could be delayed, which could lead to increased cost and time delays for the entire programme. The participants discuss this for several minutes. Eventually, the risk consultant agrees to include the risk and fills out the cause, risk and effect description fields". (O15, 34)*

The number of impure risks tends to increase over time. The most common explanation given by the risk consultants is that if they begin to include all these uncertainties, the calculated (pure) risk exposure would increase. If the risk consultants and the practice end up producing risk status reports showing increasing risk values, the argument goes, then the notion of risk management as a control device dissolves. If this happens, all sorts of political debates and actions can emerge because it may threaten the budget. If proposed risks are rejected, however, these risks cannot be entered into status reports, which means that they will "disappear", at least temporarily, from the total risk exposure calculation. The observation studies show that some risks are excluded for such "political reasons" and thus indicate the existence of another "type" of risk as well (O28, 5).

Through three exchanges, this section has shown how some uncertainties are translated into what we term *impure* risks, that is those uncertainties that have been proposed as risks by some actors, but which due to disagreement have been rejected from the practice. In summary across the different exchanges provided, this happens because the risk consultants equipped with the database, the projector and the mouse purify the boundaries of the practice. The risk consultants visualise the database on the projector screen in all meetings and utilise this when they argue against the risk owners who propose risks, which allows the consultants to reinforce their argumentation. The risk consultants, however, cannot always convince the project managers about the impurity of the proposed risks, so while approx. 120 proposed risks end up being rejected and found impure for the practice, like the examples indicate, 100 of these still remain pure for the project managers, who see them as "real" threats that need to be acted upon. Some of these risks are later translated back into pure risks as project managers gain more experience with the practice, but by far most of these are excluded. The next section looks into the effects of this mechanism as well as the role of inscription devices.

6.6.5. The effects of the production of pure and impure risks

This section looks into the effects of the processes of translating uncertainties into risks and shows how this practice has produced two overall interrelated effects: the first relates to purification, the second relates to the production of overflows. In describing the *first* effect, the produced status reports allow the practice to demonstrate its own success in achieving its objectives, i.e. purification, in terms of reducing negative events. The status reports visualise the uncertain part of the total invested capital costs, i.e. the 'value at risk', which shows decreasing risk values over the lifecycle of the programme. 'Figure 6.2' illustrates this development over time for one of the larger subprojects and depicts the development of

both pure and impure risks. As described before, the '*pure* risk value curve' (solid line) begins at a high level and then slopes downward over the years; the '*impure* risk value curve' (dotted line), however, begins at a low level and then increases over time. The actual values for the pure risk value curve are confidential and have been left out, and the impure risk value curve has been made by us on the basis of our observations. It is important to stress that the value of impure risks cannot be calculated, and that these two curves cannot be compared uncritically.

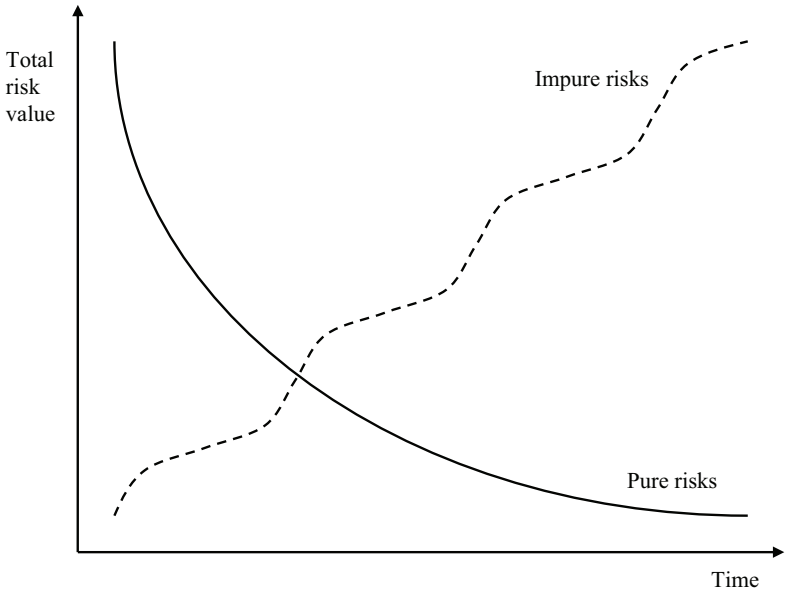

Figure 6.2: The relationship between pure and impure risks

In describing the *second* effect, the about 100 out of 120 risks observed that were excluded and found impure come to represent overflows, that is, unexpected effects resulting from the boundary work of the consultants equipped with the risk database. These impure risks are handled outside the boundaries of the formal

practice.[24] Outside these boundaries, those actors that proposed the risks that were excluded, typically the project managers, tend to construct their own localised risk management practices where they attempt to manage these risks. The following quote from one of the subprojects' head project managers emphasises this:

> *"We're actually running two parallel practices of risk management. We've got the programme's practice. If you noticed, these are risks that can affect the political milestones and the programme's milestones, or the budget for that matter. We've also got our own risk management practices, well, they are not very well specified, and not everybody has them up and running, but they will have their own, what should we call it, "databases" too, and be managed by us, you know, off the record, escaping the attention of programme management; this practice will include our risks, the project's risk, those that we find important...". (I9, 71)*

This statement shows that some project managers construct their own parallel and local practices of risk management. In this statement, the project manager explains how the programme's practice deals with the more comprehensive risks, those that can affect the highest level of the programme with its milestones and its budget. He explains that this practice cannot take into account the smaller subproject specific risks (the day-to-day operations risks), which causes them to construct local practices. These practices have their own "databases" and are "escaping the attention of programme management" and can thus include the proposed risks excluded by the practice. He later explained how these "databases" referred to other types of

[24] We recognise that both pure and impure risks change form during the processes of constructing them, but this rarely happens at the same meetings, and therefore attempts are made to handle them outside the boundaries of the more formal practice before they are potentially translated (back) into pure or impure risks.

devices, such as Excel spread sheets or IT-logs, and described how project managers would then share the risk information by means of these tools.

As the project manager suggested with the statement of "they are not very well specified, and not everybody has them up and running", these local practices are troublesome for the project managers. This is because project managers: "... are responsible for allocating the sufficient resources… to risk management" (Banedanmark, 2013a, p. 9), but because impure risks are rejected, these resources must come from "non-approved" sources. In practice, the project managers have scarce resources for performing project management, which means that operating local "non-approved" risk management practice becomes problematic. The following two quotes illustrate this; the first indicates the scarce resource issue, and the second shows what happens with many of the impure risks that are localised with project managers:

> *"We think of so many risk assessments without ever writing them down. I wanted to introduce my own local practice, but I haven't, simply because I would have had to take up my entire employee's working hours which I neither have the time nor the money for because we are running on such a tight schedule". (I9, 106)*

> *"The excluded risks are never handled. I have seen what happens with the risks that are left to the project managers; they end up on the project managers' whiteboards on yellow post-its – and every time I walk by, month after month, I see more and more post-its until they lie on the floor underneath the board." (I11, 122)*

In the period between 2009 and 2012, having their proposed risks rejected as impure for the practice, the project managers, and others, have exerted more or less pressure on the framing of the processes of constructing risks. This was, for example, evident at a risk workshop where the attending risk consultant rejected several risks, which caused six project managers to get enraged and to demand that the practice be adapted to their need (O15, 36). The discussion emerged because the project managers wanted to assess risks related to their impacts on the subproject at hand and not on the entire programme (thus criticising the cause-and-effect model). The project managers argued that they wanted to be able to include risks as 'red', despite the database requirement that 'red' risks needed to have million-euro cost impacts. The participating risk consultant disagreed, showed them the database assessment categories and argued that the size of their subproject was too small to produce anything but 'green' risks. This discussion lasted for several minutes until the project managers began to argue for splitting the database into "local" project risk assessments and "global" programme risk assessment. The risk consultant rejected this suggestion, but after strong pressure from several participants lasting several minutes, the consultant promised to look into it. The project managers later received an edited assessment structure, but assessments produced using that edited structure were never admitted into the practice and the structure remained an informal one.

In summary, the effects of the production of pure risks are that because the pure risks have been approved by programme management and the risk consultants as risks, they are made objects of systematic risk reduction and thus later acted upon. The production of pure risks further allows for the calculation of the 'value at risk', which can be used to demonstrate the success of the practice. In contrast, an effect of the production of impure risks is that local practices tend to emerge in

which some impure risks are acted upon, some are later translated into pure risks, but where most are never acted upon due to scarce resources and lack of management approval. The production of impure risks is neither structured nor systematic, and if risk reduction happens, it is unstructured; the project managers deal with this as best as they can. In addition, these impure risks are the result of the purified practice with its (contested) boundaries and become the overflows of the practice, the rejected potential threats to the practice, the programme and its objectives. So far, however, these overflows have not turned into severe threats and have not led to the reframing of the practice, but it has been contested on several occasions, and pressure on the inscription device is intense.

6.6.6. Epilogue

In early 2012, the last of the major supplier contracts were signed, which meant that the first phase, the procurement phase, of the programme had been completed in keeping with the overall time schedule. At the end of that same year, this conclusion was reinforced regarding potential cost overruns as the Financial Act of 2013 revealed calculated savings of EUR 500 million compared to the initial budget of EUR 3.2 billion (Transportministeriet, 2013). In the eyes of the public, to this date we can thus conclude that both the practice of risk management and the programme appear to be successful. At the same time, however, the government decided to reduce the programme's budget by exactly EUR 500 million, and with the actual design, test and roll-out phases still incomplete, we can only speculate as to whether this will not put even more pressure on the production (and reduction) of risks. It thus remains to be seen how the practice will cope with this, what will happen to the programme and not least what will happen if serious events that threaten the practice occur. In all circumstances, however, we will continue to follow the programme until its expected completion.

6.7. Discussion

This paper contributes to the extant accounting literature on risk management through an examination of the processes of risk management focusing on the question: how are uncertainties translated into manageable risks and what are the role and effects of risk management inscription devices. The following three subsections elaborate on our contribution: the translation of uncertainties into pure and impure risks, the role and effects of risk management inscription devices, and what happens when the risk management frame meets other frames.

6.7.1. The translation of uncertainties into pure and impure risks

This paper contributes to the literature on the distinction between uncertainties, the potentially infinite number of unknowns, and risks, the more limited amount of uncertainties that have been defined and constituted as such (Callon et al., 2009). The paper has shown that contrary to expectations, not all uncertainties were translated into risks despite representing events with potential positive or negative consequences on project objectives. Some uncertainties were included as risks, but others were excluded because agreement could not be reached on how to include them. We termed those risks included the 'pure risks' of the practice and those excluded the 'impure risks' of the practice. In explaining why this happened, the paper has shown that risk consultants in charge of the database and its distributed devices ended up purifying the boundaries between which uncertainties could be included and which could be excluded as risks. These inscription devices enforced the "meta-language risk description method" and the "traffic light assessment matrix", which framed the processes of producing risks. We have also shown that this distinction had implications for the subsequent management of risks, as only pure

risks became the object of systematic risk reduction, while impure risks tended not to be managed, and ended up as "post-its lying on the floor".

The distinction between pure and impure risks should not, however, be confused with the distinction between objective and subjective risks as described by much rationalist-cognitive and functionalist research (See Gephart et al., 2009). Neither should it be confused with Knight's famous distinction between uncertainties as "unmeasurable entities" and risks as entities "susceptible of measurement" (Knight, 1921, I.I.25). This paper draws upon actor-network theory's anti-essentialist stance from which we do not understand risks as "out there", but as the result of processes of constructing objects as risks. The distinction, then, represents an effect of the framing of the practice; this produces the realities through which practitioners understand the boundaries of what and what not to define as risks. This means that pure risks are pure for some and impure for others, and vice versa, which has less to do with risks being measureable versus unmeasurable and more to do with inclusion/exclusion mechanisms. It further shifts the focus away from the question of "objective" and "subjective" risks to that of risk acceptance, as all risks become constructs of negotiation. The risk value information that actors come to act upon thus depends on how risk boundaries have been set and function over time; something which cognitive and functionalistic researchers tend not to take into account.

This paper adds empirical depth to the suggestion that contemporary practices of risk management cannot take the full range of uncertainties into account (Miller & O'Leary, 2007; Power, 2009). We show that the framed practice with its programme/enterprise-wide and not cross-organisational-wide focus rejected the proposed risks related to day-to-day operations and/or other entities' objectives. The

practice did allow these non-enterprise risks to be proposed and judged, but when they came up for description and assessment, most ended up by being excluded; they often ended up on "yellow post-its" without being acted upon. In examining the practice, we cannot interpret that this mechanism represents an "intellectual failure", but we do show that the practice became the result of controversies and negotiations rather than a deterministic machine-like calculation related to a pre-existing risk appetite (Power, 2007, 2009). In combination we can add that these templates do remain "antithetical to the hybrid nature" of managing the full range of uncertainties (Miller et al., 2008, p. 944).

In being more explicit about the excluded risks, this paper contributes to current risk management literature by shedding light on the potential types of impure risks, something which to our knowledge remains unexplored to date. The first type we found was 'day-to-day operation risks', that is those that were "too local, too small and too specific". Objecting to that description, the observed managers argued that such risks in sum could be quite significant. The second type was those with effects on anything else but time and cost. The programme management and the risk consultants argued that risks with effects on things such as 'quality', 'operations' and 'maintenance' were outside the scope of the programme. This led to astonishment and some frustration from the project managers. The third type was those that could not be identified using the cause-and-effect description model. This type led to the negligence of the project managers' gut-feeling and intuitive ideas of new risks based on their many years of experience; these had to be able to describe the *specific* causes and effects on this. We also found that an increasing 'value at risk' curve, according to the involved actors, could threaten the overall budget of the programme. This suggests a fourth type of impure risk also: those risks that are too politically sensitive to include. This latter

type is similar to the findings of Radcliffe (2008), who in relation to auditors pointed out that there are certain things you know not to know, such as secrets or taboos, and thus do not include. We do not claim that these types of risks are the only ones, and we suggest more research be conducted to more systematically assess whether other types of impure risks can be identified.

However, despite these types of impure risks, our observation was that managers adapted to the framing but tried to rephrase their descriptions of excluded risks to make them more consistent with the established parameters of the practice. This way, some of the impure risks became included in some other form later on. We therefore see how risk management can be seen as a "game of risk" where the rules (the framing) of the practice became the object of gaming that is so frequently reported on in the management accounting literature.

6.7.2. The active role and effects of risk management inscription devices

In recent years, the roles and effects of risk management inscription devices have begun to receive attention, but our knowledge of such devises remains limited, despite the fact that studies have indicated that they are omnipresent. Jordan et al. (2013) found that technologies come to act as "mediating instruments", which enable distributed actors to resolve different interests and build confidence with the project. In addition to the finding that the expert-operated risk database ended up doing more than verbally enable the management of risks as prescribed, the database, due to the impure risks and the overflowing it co-produced, ended up constraining the processes of risk management. The database challenged the strategists in charge of the database, that is, the risk consultants and programme management, by threatening their identities as "owners" and experts of the practice. In recognising that overflows are the norm and framework, the specific risk

boundaries-setting, the exception, the implications are that management should pay more attention to how they deal with impure risks. If not, they risk that proponents of risks found impure end up frustrated and sceptical toward the formal and quite highly-invested practice. We thus agree with Jordan et al. that risk technologies serve as 'mediating instruments', but also that this concept needs to take into account the dual movement of both enabling and constraining the practising of risk management.

The accounting literature has also shown how pre-existing cultures, rationales and/or contingencies can explain the impact of different dynamics and forms of practices of risk management across countries, sectors and companies (Arena et al., 2010; Collier & Woods, 2011; Mikes, 2009; Woods, 2009). This paper argues that an explanation of the practices of risk management depends less upon the pre-existing rationales, cultures and/or contingencies and more upon the actual debates taking place during risk meetings. Our case resembles one where the enrolled actors were quite sympathetic to the whole idea of risk management and quite willingly engaged in the developed practice. Not until the very moment when disagreements and concerns emerged did some of the actors realise that not all of their proposed risks could be accepted into the practice. It appeared as if the actors started by involving themselves in the practice with an open interest and used their common sense to assess what they were presented with in terms of the database and its interface. It was during the processes of risk management that they gradually developed the view that it was problematic when the expert-operated practice did not accept what they thought should be accepted. We saw no signs that their reactions to the introduced risk management originated from pre-existing structures etc. In future research, we recommend that more attention be focused on doing comparative studies of organisations in similar conditional settings in order to

examine how uncertainties are translated into risks. If pre-existing structures, all other things being equal, remain the same, such research could look more deeply into the importance of the actual framing of the specific production of pure and impure risks.

In relation to experts and risk management more specifically, Mikes studied how experts do boundary-work to: "define what is and is not their remit, often with respect to competing or complementary fields of expertise" (Mikes, 2011, p. 227). She found that organisations exhibited a culture of either "quantitative scepticism" or "quantitative enthusiasm" and that the work of experts was contingent upon this. In complementing this finding, our paper shows that consultants become the risk experts who, besides defining their own field of expertise, also define and purify the boundaries of producing the actual risks. In taking charge of the database and both organising and running all risk meetings, the risk consultants added legitimacy to the practice which helped to settle controversies and disagreements about how to do risk management. An overflow was, however, that this caused the suppression of debates and suggestions of new risks as project managers, among others, did not feel comfortable challenging the experts. In a paradoxical finding, then, the work of experts entails the risk that significant uncertainties may not be treated as risks. This further indicates that experts both co-produce the stabilisation and the destabilisation of the practice at the same time.

6.7.3. When the risk management frame meets other frames

This paper has focused on the processes of risk management and the multitude of associations drawn between actors across formal organisational boundaries to the actual actors involved, from project managers to consultants and stakeholders. If we broaden the associations taken into account, this paper also shows that the

overall practice was entangled with the broader frame of ensuring the success of the programme. This contributes to Vinnari and Skærbæk's finding: "that different frames have linkage points to other frames that open up unexpected realities and turmoil" (Vinnari & Skærbæk, 2014, p. 518). In our paper, the risk consultants, for example, ensured that the project managers identified the effects of the risks on the programme's objectives, i.e. its success criteria, before including them. This points to the observation that the success criteria of the programme may influence the judgment of the project managers when risks are constructed. At least during interviews the actors expressed that they were well aware that increasing the 'value at risk' curve indicated uncertainty of the achievement of the programme objectives. If this is taken into account, it may explain why the 'politically too sensitive' risks, as mentioned before, were excluded, because if they had been included, this could have increased the 'value at risk' and potentially re-opened the government budget leading to potential political turmoil. It is thus evident that other frames at least momentarily entangle with the risk management frame.

All the same, we argue that we lack research that looks into the implications of the interrelatedness between risk management frames and other frames, such as capital investment budgeting or value management. As all practices more or less depend on the judgment of the people involved this means that practices depend on the various interests of actors, power relations between them, blame games when things go wrong, etc. These are all, to our knowledge, unexplored phenomena related to the actual processes of risk management. Such research, then, might expand our knowledge of how and why framing takes place the way it does, which in turn might explain why some risks come to be produced as pure while others are produced as impure. This gives rise to questions such as: Are impure risks subject to interest, or perhaps manipulation, and if so, do other frames shape the spe-

cific designs made? We also suggest that more research should be conducted outside construction projects to examine the translation of uncertainties into risks in other types of organisations as well. This paper has not attempted to generalise the specific findings, but more research could pursue this line of inquiry; perhaps the same types of risks are excluded across organisations.

6.8. Conclusion

Over the last 70 years, all over the world governments have had to accept large cost overruns on capital investment programmes, the so-called mega-projects, because they have not been able to manage uncertainties properly (Flyvbjerg, 2009). In later years, governments, think-tanks, parliaments, standard-setting bodies, consultants and ministries have been involved in applying extensive practices of risk management to such programmes in the hope of curbing such cost overruns. The overarching claim has been that these practices can improve management control and through this ensure the objectives of the programme. This paper examined the practice of risk management in one of the largest Danish capital investment programmes to date, the Signalling Programme, with capital costs of more than EUR 3.2 billion. The programme involved the first Danish attempt at introducing risk management based on the promises and ideals of enterprise-wide controlled 'good governance' and value production in the transportation infrastructure sector. This paper sought to shed light on the dynamics and complexities of the processes of risk management in order to expand our knowledge about these processes and contribute to extant accounting literature on risk management.

This paper looked into the processes of translating uncertainties into manageable risks, the cornerstone of the practice of risk management, and, in particular, shed light on the role and effects of risk management expert technologies. The paper

demonstrated that risk consultants equipped with the database management device embedded the framing of the practice and produced the boundaries within which uncertainties could be included and excluded as risks, i.e. these actors purified the processes of constructing risks for the practice. The paper theorised the included risks to be the pure risks and the excluded risks to be the impure risks of the practice and illustrated the consequences of this. The paper showed how pure risks became the object of systematic and structured risk reducing actions while impure risks did not and became personal to individual managers who still found these risks relevant. These impure risks became overflows of the practice, which came to threaten its stabilisation; they led to controversies and discussions between the participants of the practice and put pressure on the strategic centre of the practice for changes. This paper identified four types of impure risks and advised future research to examine this in more detail. The paper also advised looking more closely into how the risk management frame entangles with other frames.

In conclusion, the programme examined here did not threaten to generate budget overruns, and the programme management was able to communicate the story that the programme was well below budget. If the uncertainties rejected as risks were to become materialised in some future, however, the programme could run into trouble both in terms of budget overrun and time delays. We cannot predict this for the remaining eight years of the programme, however, because at the same time events reducing risks could take place outweighing the impure risks pointed out here. At the same time, the effects of risk reducing actions are difficult to calculate, as you often do not know whether risks would have incurred if nothing had been done about them from the outset. Risk management is a socio-technical practice imbued with controversy and disagreement about where and how the boundaries for inclusion and exclusion of risks should be drawn. The idea of the bounda-

ries within which risks are considered pure should be raised in the attention of strategic actors in risk management.

7. The performativity of enterprise risk management in large public transportation infrastructure projects

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7.1. Abstract

In light of the implementation of frameworks of enterprise risk management in large public infrastructure projects, this paper explores the relations between enterprise risk management and an in-depth examined practice of risk management. The paper demonstrates that by performing certain realities of 'risk' and 'risk management', enterprise risk management made the practice construct the risks that confirmed its propositions. It further shows that the practice had difficulty sustaining the propositions of enterprise risk management over longer periods of time because situations arose which undermined those propositions. In these situations, the paper shows that reconfiguring the risk management control system, redefining risk terminologies, and redistributing the identities of actors became key conditions for stabilising the propositions of enterprise risk management. The paper concludes by stressing the importance of understanding the dynamic interaction between material devices, language and identities of actors as conditions of long-term risk management success.

Keywords: enterprise risk management, performativity, misfire, actor-network theory

7.2. Introduction

In recent years, governments worldwide have attempted to improve the possibilities for managing large public infrastructure projects by introducing enterprise risk management or similar holistically-focused risk management concepts. This development has taken place because large public infrastructure projects historically have had trouble being completed on budget and thus have often turned into public expenditure scandals. Enterprise risk management applied to large infrastructure projects builds on the conception that project organisations carry out projects in an uncertain world faced with events that affect project objectives. It advocates that project organisations should construct an enterprise-wide integrated practice of risk management that is aligned with strategic organisational objectives and processes and carried out throughout the lifespan of the project. If properly implemented, this should enable the practice to identify, assess and reduce all material uncertainties, which all should be done in accordance with a pre-given risk appetite. Enterprise risk management sets out the proposition that when project organisations adhere to these precepts, this will provide reasonable assurance regarding the achievement of their objectives. In several countries, public agencies are now constructing practices of risk management relying on extensive frameworks of enterprise risk management and counting on them to provide that level of certainty of their objectives.

The literature looking into the relations between enterprise risk management and practices of risk management has demonstrated that practices are disparate despite enterprise risk management's clear-cut conception (e.g. Mikes, 2009; Power, 2007). In explaining this finding, the literature has pointed toward contingencies such as 'risk rationalities' (Arena et al., 2010) and 'calculative cultures' (Mikes, 2009), which shape this relation (or lack of it). The literature has also pointed to-

ward the importance of risk experts and technologies in enabling and setting the boundaries of practices (Jordan et al., 2013; Mikes, 2011). In this respect, the literature has found that experts and technologies constrain the very practice they enable, which leads to certain types of risks being excluded (Themsen & Skærbæk, 2014). It may even be that practices of risk management produce unexpected uncertainties (Vinnari & Skærbæk, 2014) or represent an "intellectual failure" (Power, 2009). It has thus also been proposed that enterprise risk management could be less concerned with operational risk reduction and more with reputational management and/or an individualisation and responsibilisation project (Power et al., 2009; Power, 2013). However, as our knowledge about the mechanisms of these practices seems incomplete, more research should inquire into the actual practices of risk management (Bhimani, 2009; Gephart et al., 2009; Power, 2013; Van der Stede, 2011).

The present paper argues that the current literature has missed out on the complex relationship between enterprise risk management and practices of risk management by underemphasising the performative effects of frameworks of enterprise risk management. The concept of *performativity* may be defined as the contribution of theories, statements, etc., to the enactment of the realities that they describe (Callon, 2007; Law & Urry, 2004). This paper shows that risk management practices become more like how they are depicted by enterprise risk management, which means that they end up producing the risks that confirm its propositions. It also shows that risk management control systems become the key mechanism for reconfiguring the practice to those propositions during times of *misfires*, i.e. when enterprise risk management makes the practice produce risks that undermine its propositions (Callon, 2010). Such control systems facilitate a redefinition of risk terminologies and a redistribution of identities, which in turn allow practices to

overcome enterprise risk management misfires. This latter aspect has so far remained underexplored in the literature, with researchers calling for more research into the conditions of performativity success during times of misfires (Butler, 2010; Callon, 2010; Dambrin & Robson, 2011; MacKenzie & Millo, 2003).

In making the above argument, this paper seeks to make a three-fold contribution. Firstly, it seeks to add to our understanding of the dynamics of practices of risk management by examining the performative effects of enterprise risk management. Secondly, it seeks to move forward our understanding of the conditions of performativity during times of misfires, using risk management as an example. Thirdly, it deals with the current conventional expectation that enterprise risk management can provide "reasonable assurance for project objectives" by considering the relation between certainty and uncertainty. In reaching these conclusions, and in order to provide detailed descriptions of this relation, the paper draws on a longitudinal case study of a risk management practice. This practice relates to a Danish EUR 3.2 billion public infrastructure projects, called the Signalling Programme, which refers to the total renewal programme of all Danish railway signalling. It also represents the first Danish attempt at implementing risk management in large public infrastructure projects based on current worldwide best-practice enterprise risk management. The project can be expected to be subject of discussions, negotiations and conflicts – especially because the government expects this practice to set a best-of-class risk management example for all other governmental organisations from departments and directorates to project organisations.

The Signalling Programme was also the object of examination by Themsen and Skærbæk (2014), who examined the processes of producing risks and their effects from the time of the parliament's decision to fund the programme in 2009 till im-

mediately before contracts with the main suppliers were signed in early 2012. This paper goes beyond the scope of that paper by extending the perspective to examine the broader set of relations associated with the risk management practice and by also taking the period from 2012 to 2014 into account. This has been done because after the contracts with the suppliers had been signed, enterprise risk management misfired due to increasing risk values, which threatened its success. This development led to controversies between the involved actors, including the strategic centre of the practice who began to discuss the purpose of risk management and how to reorganise the practice in order to reduce these risk values. The response came when the consultants operating the practice readjusted the risk management control system to allow more actors, such as the main suppliers, to be included. This helped to some extent, but not sufficiently; so after a period of turmoil, the consultants also embedded new risk terminologies, such as 'sub-risks' and 'non-approved risks', into the control system and re-distributed the responsibilities between the involved parties. This ultimately reduced risk values and stabilised the practice.

The rest of this paper has been structured as follows: The first section looks in more detail into the accounting literature on enterprise risk management and describes the concept of performativity and its conditions of success. The second section presents the case-based method including the benefits of choosing this method when examining the relationship between enterprise risk management and the world of practice. The third section gives an introduction to the Signalling Programme and the emergence of the enterprise risk management programme in large transportation infrastructure projects in the Danish public sector. The fourth section describes the findings, which have been divided into four subsections: the configuration of the risk management practice, the emergence of concerns, the

growth of concerns, the misfiring of the practice and the re-configuration of the practice. The fifth section summarises the findings and discusses their implications on current understandings of risk management, and the last section concludes the paper and sets out directions for future research.

7.3. The accounting literature on enterprise risk management

In recent years, the accounting literature has shown that risk management has been moved up on the public and private sector agendas to the point of transforming the fundamental nature of organisational management (e.g. Miller et al., 2008). This development has been stimulated by numerous transnational public and private sector standard-setting bodies who have promoted the same concept of *enterprise* risk management (Power, 2007). In these years, enterprise risk management has become an integral part of best-practice internal control and good governance across countries and organisations alike (Power, 2004; Spira & Page, 2003). This also follows from the literature on large infrastructure projects in which the ideals of enterprise risk management has become an increasingly important part of good project management (e.g. Winch, 2010). The following excerpt taken from the worldwide recognised "best-practice" COSO ERM framework defines the concept of enterprise risk management:

> *"Enterprise risk management is a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across enterprise, designed to identify potential events that may affect the entity and manage risks to be within its risk appetite, to provide reasonable assurance regarding the achievement of the entity's objectives". (COSO, 2004a)*

The above definition illustrates the key proposition of enterprise risk management, something that other frameworks resonate (Raz & Hillson, 2005) and which bears many similarities to common management control propositions (e.g. Mikes, 2009). It builds on the key proposition that by implementing enterprise risk management, organisations obtain reasonable assurance of being able to achieve their objectives. In more details, this objective can be obtained by setting out an input risk appetite and by following the iterative process of: risk identification, risk assessment, risk reduction, and monitoring and control, to make sure that the residual risk value can be contained within the risk appetite. Power has compared this basic conception to the logic of that of a thermostat: "…which adjusts to changes in environment subject to a pre-given target temperature" (2009, p. 849). Further, risk identification should follow a cause-and-effect logic between potential events and organisational objectives; risk assessment should be conducted by quantifying likelihood and impact probabilities of the events and by mapping and prioritising them using matrixes and maps; risk reduction should be planned, prioritised and carried out on the basis of those assessments; and monitoring and control should provide feedback to the process and adjust the practice to meet the pre-determined risk appetite. In capturing its core rationale, enterprise risk management thus reflects a long tradition of a functionalistic theorisation of uncertainty and risk (e.g. Bernstein, 1993; McGoun, 1995).

The literature has also shown that enterprise risk management, when being applied to the world of practice, becomes: "...different things in different organizations, or even within the same organization, at different times" (Arena et al., 2010, p. 659). This stands in contrast to the otherwise clear-cut conception of the enterprise risk management concept. In explaining this discrepancy, Mikes (2009) found that different calculative cultures existed which were polarised around the enthusiasm or

scepticism towards risk measurement and modelling. She argued that these cultures shaped management predilections towards risk management and served as important constituents of the fit between risk management control systems and organisational contexts. Arena et al. (2010) later argued that enterprise risk management introduced new rationalities which diverged as they encountered already pre-existing rationalities in the organisation. In this divergence, they found that risk experts and technologies were important for explaining how practices ended up being different. This was expanded upon by Mikes (2011), who found that risk experts, doing rhetorical boundary-work, were important for understanding the expansion and limitation of the different types of risk cultures. Jordan et al. (2013) further found that technologies served as 'mediating instruments', referring to Miller & O'Leary's (2007) definition of this concept, which due to their generic construct enabled the building of confidence and the resolving of differing interests between people.

In light of the above disparateness between practices, Themsen and Skærbæk (2014) further looked in depth into the specific processes of practising risk management. They found that besides limiting and expanding practices of risk management, consultants/experts, equipped with technical risk devices, ended up setting up boundaries between what a practice considered acceptable as risk, and what not. They further found that this led to the unintended effect of rejecting certain uncertainties as risks, which turned some of these uncertainties into threats against the programme because they were never handled by the involved actors. Vinnari and Skærbæk (2014) also identified unintended effects when they concluded that risk management, besides reducing uncertainties, also created unexpected uncertainties due to its entanglement with other frames important to actors. Related to this, Power (2013) also suggested that risk management could be more

about an individualisation and responsibilisation project aimed at getting managers to govern themselves rather than about actual risk reduction; and Power et al. (2009) further elaborated that risk management could be more about the management of reputational uncertainties rather than operational uncertainties, which should be seen as a logic of organising rather than a discrete manageable object.

In understanding the relationship between enterprise risk management and practices of risk management, however, the current literature has tended to focus on explaining variations between practices and/or the effects generated by the practising of risk management. The literature has tended not to deal with the potential performative relationship between frameworks of enterprise risk management and the resultant constructed practices around them. In taking this perspective, the current literature has missed out on whether differences between practices might be the result of different implemented frameworks of risk management rather than, for example, of the enabling and limiting effects of technologies, expert and/or calculative cultures. This is not to say that these elements are not important elements of the construction and operation of risk management practices, but it is to say that (enterprise) risk management may end up enacting the realities of risk management practices in addition to the transformative work of experts, the enabling and constraining effects of technologies, etc. If a performative relationship exists between frameworks and practices of risk management, this means that we will have to rethink our understanding of what it means to practise risk management.

7.4. The concept of performativity and its conditions of success

In approaching the relationship between enterprise risk management and the resultant practices of risk management constructed around its propositions, this paper draws upon the concept of performativity as defined by constructivist litera-

ture. This concept can be defined as the contribution of theories, statements, prescriptions, etc., to the enactment of the realities that they describe (Callon, 2007; Law & Urry, 2004). It builds on the conception that when understanding the relationship between theories, prescriptions, statements, etc., and the world that they describe, they also bring about that world (Callon, 2007). In the accounting literature, this argument has been applied to explain how devices such as budgets or balance sheets shape organisational practices. Skærbæk and Tryggestad (2010), for example, showed that accounting devices ended up rejecting, defending and changing corporate strategy by mobilising concerned groups of actors; Dambrin and Robson (2011) found that in the pharmaceutical industry, performance measurement devices shaped drug representatives' performance measurement practices; and Cushen (2013) found that budgets served as a performative mechanism through which top management could narrate specific realities and pass down inventions.

The concept of performativity breaks with the traditional understanding of theories as "true" descriptions of the empirical world "out there" and refocuses our attention instead on the *conditions* under which theories can be made to be successful (e.g. Austin, 1962). These conditions range from the linguistic (e.g. Austin, 1962) and social-symbolic (e.g. Bourdieu, 1991) to the socio-material (Callon, 2007). In bringing these conditions into the management literature, Ferraro et al. (2005, 2009), argued for three overall but non-exclusive conditions: the promulgation of language, the shaping of organisational arrangements, and social behavioural norms. Callon (2007) argued for also taking material assemblages into account, such as "prostheses, tools, equipment, technical devices [and] algorithms" (Callon, 2005, p. 4). He also argued that with the move to examine the conditions under which theories becomes performative, rather than just descriptive, the focus

should rather be on the adjustment process between the world and the statement which produces that world, i.e. the bracketing of the world:

> *"The actualization process is a long sequence of trial and error, reconfigurations and reformulations. But what makes this process possible is the performative dimension of the statement and the trials they allow… The conditions of felicity of a (performative) statement, that is, its success, depend on this adjustment, an adjustment that is never given in advance and always requires specific investments". Callon (2007, p. 320)*

In the above quotation, Callon (2007) further described that the adjustment process always remains an open and continued sequence of trial and errors, reconfigurations and reformulations. This statement means that a performative relationship *tends* to produce the phenomena and therefore sometimes can *fail* to produce what it anticipates (Butler, 2010). In other words, performative relationships must be open for situations of breakdowns at the very core of the concept. Callon (2010) has elsewhere described such situations as *misfires*, which refers to situations where theories, statements, and such, lead to unexpected outcomes.[25] MacKenzie (2006) has also described such situations with his notion of counter-performativity, which refers to situations where theories because of their application make realities less like their depiction. In the academic literature, what those conditions are during times of misfires and how they interrelate remains something that we lack knowledge about (e.g. Butler, 2010; Callon, 2010). Dambrin & Robson (2011), for example, never looked into what those conditions could be de-

[25] Callon (2010) compares the notion of misfires with that of overflows. See Section 8.4 for more a more in-depth description of the concept of overflows (and its intrinsic linkage to the concept of framing).

spite finding that resistance did emerge that to some degree challenged the performance measurement practice; and MacKenzie (2006) never examined the conditions under which performativity could be re-established during times of counter-performativity.

This paper firstly applies the concept of performativity to understand the relationship between enterprise risk management (the theory of risk management) and a practice of risk management. It secondly examines the conditions under which the examined practice was successfully re-established according to the propositions of enterprise risk management during a period of misfiring and thus examines the conditions under which performative relations can be re-established during times of misfires. In relying on Callon's understanding of the concept of performativity, this means examining how the practice was configured and reconfigured over time to reflect the world brought about by enterprise risk management. In more details, this means examining how human actors such as project managers, suppliers, consultants, and management, and non-human actors such as control systems, were brought into the practice, the trial and errors that followed, the challenges that emerged, and how all of this related, or not, with the propositions and statements of enterprise risk management. It also means examining how identities or roles were (re)distributed between actors, how they carried out their work over time, the reports that ended being produced, the values calculated, and more.

7.5. Method

This paper makes use of an in-depth and longitudinal case study to examine the linkage between the prescriptions of enterprise risk management and a resultant constructed practice of risk management. I have chosen this method because it provides an opportunity to follow adjustments 'in action' as they take place over

longer periods of time. More specifically, I examine the Danish EUR 3.2 billion public railways infrastructure project called the Signalling Programme. This programme deals with the total renewal of all Danish signalling equipment, ranging from basic train detection and point machines to the overall traffic management system as well as on-board train systems. I have chosen this programme because it was the first Danish attempt at implementing enterprise risk management, which meant that the involved actors were confronted with having to do something for the first time. In following this programme, I thus got the opportunity to provide detailed empirical descriptions about the development of a risk management practice where associations had not yet been stabilised. Ferraro et al. (2005) and MacKenzie (2006) have both argued that in order to account for performativity, some kind of historical perspective of the "before-and-after-the-theory-was-implemented"-situation is required. This paper looks into the developments that occurred before, around, and after 2012, when the precepts of enterprise risk management misfired, and it thus adheres to this specific methodological point for examining performative relations.

I have approached the case study by following the practice 'in action' and traced the associations between 'the actors that did something' according to actor-network theory principles (Latour, 2005). In this relation, I have concentrated my data collection around those actors that were involved throughout the examined period and those either involved or concerned with the risk management practice. These actors were primarily the programme director, the head of secretariat, several risk consultants and various project managers from the different subprojects. In extending the examination to the associations drawn between those actors not employed but still involved with the practice, I have also included different suppliers, external consultants no longer affiliated with the programme and civil serv-

ants from the ministries supervising the programme. In my approach, I continued to collect data up until the point where I did not learn anything about new associations being drawn (Latour, 1996).

In drawing my conclusions and in order to cross-validate them, I have made use of three formal data collection techniques: non-participatory observations studies, semi-structured interviews and document analysis. I have conducted more than 40 non-participatory observation studies in different types of risk meetings, ranging from operational risk identification and assessment meetings to overall management approval meetings. In these meetings I have been able to observe the discussions taking place around the (re)configuration of the practice. I have also done 19 semi-structured interviews with different involved actors, such as the programme director, risk management consultants, project managers and more. These interviews provided me with the opportunity to ask questions about observations and to go more in-depth into the events that emerged and which caused concern in the meetings. All interviews were recorded and transcribed upon the interviewees' acceptance. The document analysis includes the collection of the formal documents related to risk management, such as risk status reports, risk management plans, and risk strategy documents. These documents have helped me to follow the formal adjustments made, the status and development of risks, and the calculation and visualisation of risk values. In sum, these techniques have allowed me, all in different ways, to follow the (re)configuration of the risk management practice constructed.

In following this practice, I have also had access to the major risk management control system implemented to support the management of the practice. Themsen & Skærbæk (2014) established that this system, which was operated by consult-

ants, purified the process of producing risks and was imperative for understanding the framing of the practice. I have built upon this observation and looked into the adjustments made to this control system during the period of the misfiring of the practice, as well as other sources, to understand how the practice was re-stabilised. I have also drawn upon more informal data collection techniques such as email correspondence and lunch-break and casual post-meeting conversations. The main purpose of adding these sources has been to gather information on which meetings to attend, which actors to interview and which events that sparkled concern. It was my source to keeping up with the events that took place in-between meetings, as the sheer size of the programme prevented me from observing all meetings and interviewing all actors. Together, these more informal sources, including my access to the database, have improved my understanding of how the propositions of enterprise risk management were again made to come true.

7.6. Background: The Signalling Programme and risk management

This section describes the Signalling Programme's involvement with key actors in the Danish public sector and how and why it came to be intertwined with the emergence of an enterprise risk management programme. The purpose of this is to describe the objectives that the constructed risk management practice was intended to meet. It all began in 1997 with the establishment of Rail Net Denmark (Banedanmark) as a separate state-owned enterprise under the auspices of the Danish Ministry of Transport (Transportministeriet). Rail Net Denmark manages the maintenance and development of the Danish railway infrastructure, including all railway infrastructure projects such as the Signalling Programme. The organisation was established in response to pressure from the European Union in an attempt to separate train operations from infrastructure ownership as part of making train operation more competitive. Up until that point, Rail Net Denmark had been

part of the Danish state-owned train operating company, Danish Railways, or DSB, which still today remains the largest train operator by far in Denmark. Rail Net Denmark employs more than 2,000 people and receives approx. one fourth of all annual government capital appropriations (Banedanmark, 2013b).

In the years between 2000 and 2005, however, Rail Net Denmark became the object of increasing criticism by the Danish Ministry of Finance (Finansministeriet) and the National Audit Office of Denmark (Rigsrevisionen) for its "inadequate management accounting practices [my translation]" (Rigsrevisionen, 2002, 2004, 2005). In 2005, the consequences of this became evident, as the condition of the Danish railway infrastructure had deteriorated to the point where train operators incurred so massive delays that reliable train operation was severely hampered. In the same year, the Danish parliament decided to grant approx. EUR 2.7 million to Rail Net Denmark to systematically assess how poor these conditions really were, and, if necessary, set up different investment strategies for dealing with the situation (Finansministeriet, 2005). Booz Allen Hamilton, a consultancy company, was contracted to make this assessment. In 2006 their report came back showing that the Danish signalling systems had aged to the point where many of the existing systems had overrun their technical service life (Booz Allen Hamilton, 2006a). The report suggested a total renewing strategy of all signalling equipment, which later that year prompted the Danish parliament to decide on and appropriate another approx. EUR 13.3 million towards a more detailed investment proposal (Finansministeriet, 2006).

At the same time, however, The Danish Ministry of Finance had grown sceptical of the calculation technique applied to forecast major Danish public infrastructure projects. At that time, the most common technique applied was successive calcula-

tion; a method that based on statistics integrates cost estimates with risk analysis in order to arrive at a more precise total cost estimate. However, the Danish Ministry of Finance, had for some time experienced that projects budgeted using that principle tended to end up having incurred huge cost overruns (Finansministeriet, 2010). The Ministry also knew that the same tendency was seen in projects abroad and that research had shown this to be the result of strategic misrepresentation, meaning that successive calculation and similar calculation techniques were open to political manipulation (e.g. Flyvbjerg et al., 2002). As a result, the Danish Ministry of Finance decided to collaborate with the Danish Ministry of Transport on developing what was later to be called the "New Budgeting Method". On 24 October 2006, this method was introduced in large transportation infrastructure projects under the auspices of the Ministry of Transport that had a separate appropriation on the Financial Act or had been otherwise legislated on by the parliament (Transportministeriet, 2006).

The "New Budgeting Method" introduced several new aspects into the budgeting of large infrastructure projects, including a ban on successive calculation, which was replaced by the use of experience-based costs from earlier projects (Transportministeriet, 2006). This meant that all risk estimates had to be excluded from budget calculations. In the recognition that cost overruns might still happen, however, an experience-based contingency reserve, or risk margin, of 30 per cent was to be added on top of the now risk-excluded budget. In the guidance document accompanying the "New Budgeting Method", it was further stated that project management control practices had to be supported by a far more systematic approach to risk management (Transportministeriet, 2008). This was implemented to as far as possible prevent the use of the risk margin and to provide certainty for project objectives. Furthermore, it was stressed that this practice had to be imple-

mented and operated throughout the lifetime of the project and rely on fixed operating and documentation procedures. Implementation of an IT-based risk management control system was made obligatory, along with a long list of more specific requirements. In this respect, the Ministry of Finance argued that risk management practices were to be constructed on the basis of best-practice risk management referring to, among other aspects, the before-mentioned COSO framework (Finansministeriet, 2007).

The Danish Ministry of Finance, however, was uncertain about how to implement the "New Budgeting Method", and it was at that time that the decision had to be made on whether to go ahead with a more detailed investment proposal of renewal the signalling equipment. Consequently, the Danish Ministry of Finance decided to take the opportunity to test the "New Budgeting Method". It took approx. another two years to complete the decision report, but on 29 January 2009, the Danish parliament decided to fund the EUR 3.2 billion programme to renew all Danish railway signalling before 2020 for the Copenhagen S-bane, and before 2021 for the regional lines, using the "New Budgeting Method" (Banedanmark, 2008b). The Signalling Programme thus ended up becoming the first Danish attempt at implementing an enterprise risk management practice with all it entailed. In 2010, the Danish Ministry of Finance declared the implementation of the "New Budgeting Method" a success, and today the Signalling Programme serves as a best-practice illustration for the rest of the public sector of how to approach dealing with uncertainty, risk and risk management (Finansministeriet, 2010).

The Signalling Programme has been structured as a separate project organisation under the management of Rail Net Denmark and the auspices of the Danish Ministry of Transport, and it employs more than 120 people on average. Its main advi-

sors are Ramboll (Denmark), Atkins (Denmark), Emch+Berger (Switzerland) and Parsons Group International (UK), who have formed a consultancy conglomerate. The project has been organised into three major subprojects: regional lines east (f-banen east), regional lines west (f-banen west) and the Copenhagen mass transit system (s-banen), and it covers the replacement of all signalling equipment from basic train detection and point machines over the overall traffic management systems to on-board train systems. It is scheduled to run from 2009 to 2020/21 and has been divided into four main project phases (see Appendix 3). The overall main objective of the project is to reduce signalling errors by 80 per cent on regional lines and 50 per cent on the transit system in order to reduce travel time and increase train punctuality. In addition, an important requirement is that the project must be completed on time (several milestones have been established) and without exceeding the budgeted costs. This paper focuses on events happening before, during, and after the shift to the design phase for f-banen.

7.7. The performativity of enterprise risk management

The following section contains the analysis and has been divided into four subsections which together illustrate how enterprise risk management ended up being performative on the practice of risk management. The first subsection begins by showing how several actors were brought into the practice and how this practice came to be configured according to the propositions of enterprise risk management. This led to the enactment of a certain reality of 'risk' and 'risk management'. The second subsection shows how the practice and its involved actors actualised this configuration over time, which led to the production of risks that confirmed the propositions of enterprise risk management. The third subsection shows how certain events caused the practice to misfire, that is, made the practice produce risks which undermined the propositions of enterprise risk management;

and the fourth and last section rounds off the analysis by describing how the practice overcame this misfire and again produced the risks required to demonstrate the propositions of enterprise risk management.

7.7.1. The initial configuration of the practice of risk management

In 2006, Booz Allen Hamilton had concluded that the most serious risk to the success of the project was that Rail Net Denmark lacked the proper project management skills within the organisation to handle such large and complex projects (Booz Allen Hamilton, 2006a). In 2009, when the programme had been finally approved, Rail Net Denmark responded to this risk by contracting one of their current advisors, Ramboll, to construct and operate a risk management practice. In the months that followed, risk consultants from Ramboll started constructing such a practice. This subsection describes how the consultants carried out this configuration work. This includes a description of how the consultants rhetorically defined notions of 'risk' and 'risk management', allocated specific roles to key actors, and invented an IT-based risk management control system to assist the practising of risk management. It also describes how the consultants configured these elements according to the precepts of best-practice risk management.

> *"When we decided how we wanted to construct the practice, we agreed that we would follow PMBOK to define our risk terminologies. We just didn't want people to question our understanding of risk management… There are so many ways [to construct a practice] and it is hard to tell what is right or wrong. But if we can agree that we use this approach, "that's it". It's just more simple like that". Senior Risk Consultant (I2, 66, 73)*

As the above statement demonstrates, Ramboll wanted to configure the practice around an area that people were familiar with in order to avoid unnecessary questions about their approach. Ramboll therefore decided to follow the Project Management Institute's Body of Knowledge (PMBOK), which to the actors involved was already a well-known "best-practice" framework they had applied in earlier large projects (I4; Banedanmark, 2007). In adhering to PMBOK, they defined 'risk' as "…an uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objectives" (Banedanmark, 2009b, p. 26), and 'risk management' as the practice "to increase the probability and impact of positive events, and decrease the probability and impact of events adverse to the project" (Banedanmark, 2009b, p. 2). These risks were furthermore described as those "that may impact the final performance and functions of the resulting systems as well as cost and time schedule for the programme". In all aspects, their configuration of the risk terminologies to be used was consistent with the PMBOK enterprise risk management programme, and consequently it was also relatively easily approved by both programme management and the government (I2; I4).

The consultants configured more than the terminologies of the practice; they also sought to include several key actors by giving them risk responsibilities. The consultants described two main groups of actors and their roles: project managers as risk owners, and the risk consultants themselves as supervisors or experts. The project managers were described as those responsible for identifying and assessing risks in the relevant risk meetings and the subsequent reduction of these risks; and the risk consultants as those responsible for the management of the practice, which included calling meetings, preparing status reports and operating the risk management control system. The document also identifies people such as controllers, civil servants, suppliers, programme management and the secretariat as potential

risk owners, depending on the complexity of the risk. The consultants further defined three types of meetings: risk workshops, where new risks were to be identified, risk follow-up meetings, where these risks were to be reassessed, and cross-risk review meetings, where project managers across subprojects could meet to coordinate their risk assessments if needed. It was evident that these meetings were those in which the actual practice had to be carried out.

The consultants also invented and implemented an IT-based risk management control system to assist them in managing the risk management process, such as to keep track of the identified risks and risk reducing measures and to generate overviews of the current risk status. The features of this control system even allowed them to keep track of responsibilities and actions, to present plans for risk reduction, to provide documentation for what had been accepted and by whom, and to produce visualisations of current risk management progress. This latter feature included producing tables with current 'top ten risk' lists and 'value at risk' curves, that is the total expected financial value at stake. To the strategic centre of the practice, the demonstration of decreasing 'value at risk' over time was imperative for risk management success, as it represented the residual uncertainty regarding the achievement of project objectives. In interviews with key actors in the practice, this was important, not because 'value at risk' represented any "true" value, but because its relative development over time demonstrated how the practice progressed. For the project managers, however, the more detailed descriptions of the risks was more interesting, as they focused on how risks could be managed as part of their other work routines, which meant that they used the 'top ten list', or more complete lists depending on the size of the subproject, more.

7.7.2. The actualisation of the world of enterprise risk management

In the beginning, everybody involved was very positive towards the way that the practice had been configured and several risks were constructed and included into the practice according to the precepts of enterprise risk management. Thus it did not take long before the practice presented a significantly decreasing 'value at risk' curve, very much to the satisfaction of the strategic centre of the practice. At the same time project managers felt that practising risk management improved their project management abilities, so to them the practice was also a success.

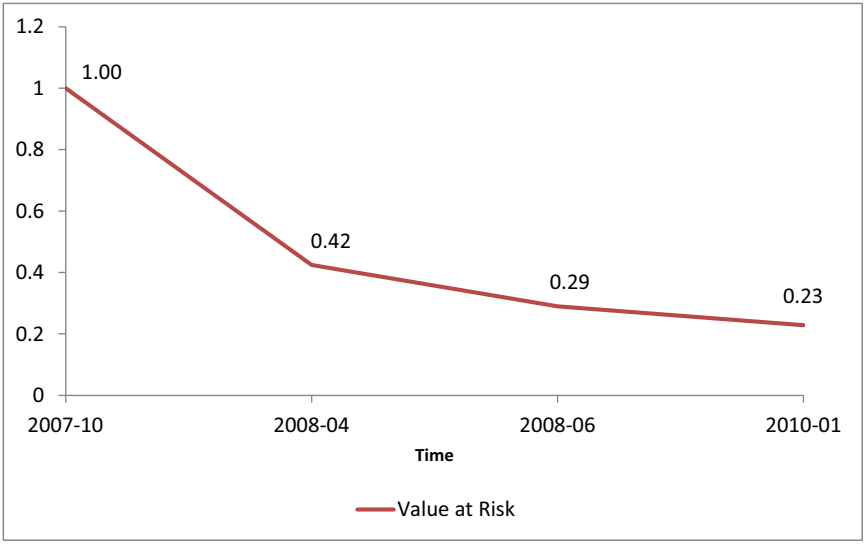

Figure 7.1: The Signalling Programme, Regional Lines (East + West), Project Proposal Phase: 'Value at Risk' calculation

Figure 7.1 shows the development of the 'value at risk' curve for the regional lines subproject, which in its overall development also represents the development of the mass transit system subproject. The x-axis shows the indexed 'value at risk' ("1" points to the initial 'value at risk'), while the y-axis shows the development

over time. It has been indexed, as actual monetary values at risk are confident and shows the period from the initial investment report to the end of the project proposal phase, which in practice turned out to be from approx. 2007 to the end of 2009. To those involved, this curve demonstrated that the practice was indeed creating a higher degree of certainty of the objectives of the programme.

About that time, however, concerns also began to emerge slowly. At the beginning of the project, these concerns were held only locally by individual project managers who found specific elements of the practice encumbering for their other job responsibilities. Some project managers, for example, did not always attend meetings, did not prepare for the meetings, or expressed their frustration with the number of meetings. Others argued that the practice was only about compliance with management requirements, that the concepts of risk identification and assessment were too subjective, or that the whole notion of risk management was flawed. The consultants dealt with these concerns through dialogue with the project managers in risk meetings and workshops, where they were given explanations of the purpose and relevance of the practice. This helped to reduce the concerns before they turned into controversies, or outright conflicts, leaving "only" overall concerns about risk management. The following quote illustrates overall concern about risk management which did not destabilise the practice, but still expressed something that was believed to be troublesome by several actors:

> *"To the best of my belief, risk assessment has the fundamental problem that it has to be within the limitations of the human psyche for what we can plan, which is a maximum of one year. This programme runs 10 more years... It's impossible to produce reliable assessments". Risk Manager (I1, 159)*

By the end of this phase, however, stronger concerns were voiced by more than just individual managers as the project progressed; concerns which were shared between project managers across the different subprojects. One of the major concerns from the outset was that risks had to be entered one by one into the control system by the individual subprojects' head project managers, even though some risks were shared among them. This meant that multiple versions of the same risks existed in the control system, which in turn caused problems for the project managers having to identify which were theirs. In the worst case, this meant that the same risk was constructed multiple times, which led to frustrations among the project managers, as they felt it was a waste of time. The consultants who had to do the actual entering of the risk information into the control system agreed; however, this time the consultants readjusted the control system's underlying database to the effect that each of the two major subprojects (regional lines east and west here being considered as one) would have their own database (O1, 4). The consultants had to admit that this did not do anything to solve the problem that only one person could access the database at a time, so on the long run another solution had to be worked out.

While this was worked on, however, project managers more systematically began to develop concerns about how to do reliable risk assessments. In the original configuration of the practice, the consultants had outlined that project managers in their capacity as risk owners should assess risks according to the extent to which they impacted on project cost, time, benefits, punctuality and reputation. However, the project managers found it almost impossible to assess the effects of risks on benefits and reputation, as this was too abstract for them. The argument was that because the project ran for such a long period and since no similar project had

been attempted before, they had no reliable information on which to base their assessments. They did find it useful to assess effects on cost and time, because this was something they were used to doing, but it still caused problems for some of them. With the programme management's approval, the consultants responded by encouraging discussions in meetings and by accepting that assessments relating to reputation and benefit did not have to be made:

> *"We were told by programme management to cut down costs on risk management, and reputation and benefit were two of the categories the project managers were struggling with anyways, so we took them out. It made good sense at the time and people were happy". Risk Consultant (O18, 16)*

Other project managers also had concerns about the actual options they could choose from when doing their cost and time assessments. In accordance with the traffic light assessment matrix of the control system, the project managers had to choose between fixed consequence and probability options (see Appendix 4 and 5). For the smaller subprojects, in some situations this meant that all their risks would be grouped into the same field of the matrix, namely the lowest ranking or the "green" area. For the project managers, this led to concerns about whether programme management would even notice their risks, as particularly the larger subprojects often showed many more risks, which were even often categorised as "red". The project managers, however, remained loyal to the practice during this period, and the concerns, albeit gaining in momentum, remained insignificant; they identified, assessed and reduced risks like the consultants asked them to in conformity with the framework. The consultants, again, also did their best to solve concerns as they emerged, and in collaboration with programme management they

managed to do so with only small adjustments to the practice, which did not challenge the core conception of the framework they were drawing on.

7.7.3. Growing concerns and continued pressure on the practice

In the subsequent two years, from approx. 2010 to 2012, the project entered into the procurement phase, which lasted until contracts had been signed with the main suppliers. During this period, the number of concerns increased, although they were still managed by the consultants and programme management without causing any major adjustments of the practice.

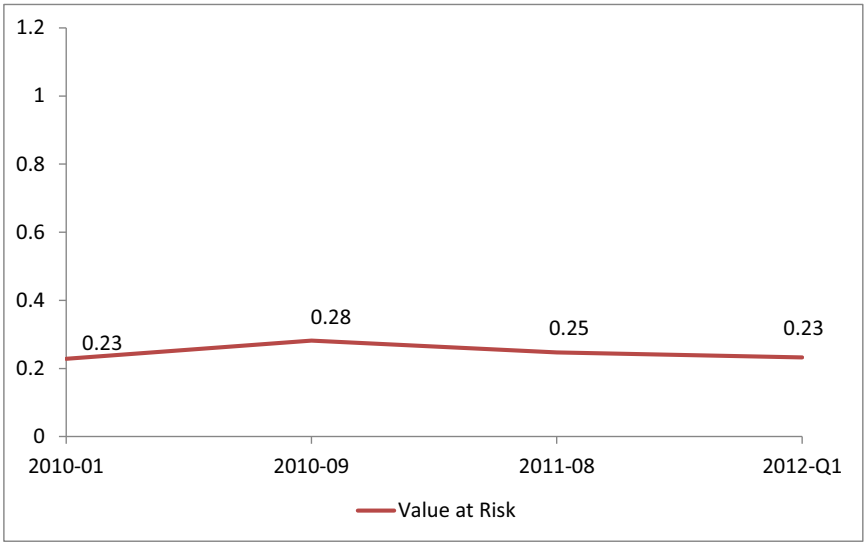

Figure 7.2: The Signalling Programme, Regional Lines (East + West), Procurement Phase: 'Value at Risk' calculation

Figure 7.2 shows the overall 'value at risk' development during the procurement phase (in practice, approx. from 2010 to 2012). The figure indicates that despite a small increase in 2010, 'value at risk' ended at the exact same index level as it had

been at the beginning of the procurement phase. In general, this reflected that contracts were signed below their expected costs, which had reduced the overall concerns about the projects. This was evident from interviews, observations and presentation material, where actors expressed satisfaction with the contract negotiations. It was evident that the programme director had managed to secure several biddings, which had allowed for an advantageous bargaining position. In this way, the Ministry of Transport could also report that Rail Net Denmark had been able to give back about EUR 500 million to the Ministry of Finance due to savings made during contract procurement (Transportministeriet, 2013). In the eyes of programme management, the consultants themselves, the Ministry of Finance and the Ministry of Transport, the risk management practice had done well.

In the midst of all this, however, the project had grown to involve more than 120 employees, and the consultants were faced with an increasing number of risks that had to be described, assessed, followed up on, and recorded in the control system. This meant that still more risk information had to be processed, which made it almost impossible for the consultants to keep up. Recalling the earlier concerns expressed by project managers about this practice being a time-consuming exercise, the consultants and programme management began to examine how the practice could be made more efficient. In this respect, the identification and assessment of risks with positive effects had been attempted, but as project managers had problems identifying any, this effort had been stopped (I12). It also followed that as the project was following a best-practice project management framework, it implied an extensive practice of value management, which because of its focus on positive events overlapped with the risk management practice, which gave rise to interface problems (I12). As a result, the consultants also had concerns about how to include positive events again (I12).

Another characteristic of that period was that the programme management and the risk consultants became aware that the practice was vulnerable to biased, high-risk assessments. As prescribed by the "New Budgeting Method", the practice was expected to involve stakeholders to broaden their perspective of the potential risks the project faced. In 2011, the programme management and the risk consultants therefore decided to involve one of the large train operators by inviting them to identify and assess what they found to be the risks of the project. To enable the train operator to return usable information, they were allowed access to the control system assessment structure. When the programme management and the risk consultants received that assessment, however, the train operator had assessed the costs of the risks to be more than 50 per cent of the entire programme's capital costs and multiplied the present 'value at risk' calculation considerably. In effect, this led the programme management to believe that these assessments had had to be biased and subsequently had them removed from the control system. The consultants proposed to include them anyway, but programme management refused, as they expected this to give rise to unnecessary questions about the status of the programme. In sum, the situation led to concern about what to do if risks were suddenly given high assessments; the practice did not include any means to prevent this from happening, apart from manual rejection by senior managers or exclusion of actors:

> *"We would love to have more dynamics, I mean that's why we are doing this, but we need to have managed dynamics, and that is difficult, because, we would like to have as many people to make changes as possible, that's what motivates them, that's the right to do something, but this right entails that sometimes you can do*

something that we maybe don't appreciate – or where we have different views… I don't mind increasing the value by five per cent or something like that if it means that it makes people do something or think, but I can see that it is extremely difficult to explain [and we need to be able to do that]". Risk Consultant (I12, 693-704)

The above quote illustrates that the risk consultants (and programme management) did not mind increasing the 'value at risk' calculation, which meant including highly assessed risks in terms of costs, but they insisted that such assessments had to be accompanied by good explanations and thus made on justifiable grounds. This meant that assessments made solely on the basis of project managers' experiences, hunches and feelings were considered biased and therefore had to be excluded. In consequence, more and more project managers started to game the assessment categories of the control system by making up reasons for their hunches, experiences, etc. One of the more common strategies was for project managers to come up with reasons for increasing already existing risk assessments in order to increase management attention, like the previous example with the train operator illustrates, but they also sometimes made up reasons for reducing risk assessments in order to avoid having to report on them. It did not matter how this gaming occurred, though; whenever discovered it caused concern with the consultants and programme management who needed the practice to produce assessments on justifiable and documentable grounds. In some cases this resulted in conflicts with the project managers who started to question whether the practice had been made to show progress rather than for the purpose of actual risk reduction. In most cases this was just an expression of frustration on the part of the project managers, and they would later do their best to reduce risks; but during this period some (head) project managers began to develop their own local practices to complement the

formal practice, which indicates the onset of a slow breakdown of the specific world enterprise risk management had brought about. At this point, however, this had little effect and the 'value at risk' curve remained steady through this period.

7.7.4. The misfiring of enterprise risk management

In the first months of 2012, contracts were signed with the three main suppliers that were to implement the new signalling systems on the east and west regional lines and the mass transit system. In keeping with the "New Budgeting Method", these suppliers were integrated into the project organisation in order to improve collaboration and knowledge sharing between the different parts of the organisation, which also included risk management. It did not take long, however, before the consultants became aware that they were having severe problems with the inclusion of the suppliers' risk suggestions. The suppliers often had a different understanding of how to define and assess risks, and because they often demonstrated very detailed, technical expertise of the project, the project managers and the consultants had problems arguing against their risk suggestions. This meant that they were forced to include the risks by transforming them to fit the IT-control system structure. The consultants tried to deal with this by expanding and elaborating on already existing risks whenever possible in order to avoid having to increase the number or the value of them, but this proved difficult, and the number and value of the risks almost literally exploded. In other words, the practice began to misfire, meaning it had begun to generate uncertainty about whether risks were being handled, which in turn generated uncertainty about whether project objectives could be met.

Another related matter was that the suppliers would sometimes disagree with the project managers' own risk suggestions during meetings, which led to conflicts

that were not always resolved and thus left risks hanging without risk ownership. It also often occurred that project managers and suppliers would argue as to who was financially responsible for paying for the risk-reducing measures, which also sparked unsolvable situations. In practice, outside the scope of risk management, the actors solved their issues in the best possible way, even though, as mentioned by one project manager, the cultural differences between suppliers from different countries often gave rise to conflicts. In the middle of all this, however, the consultants were under pressure from programme management to solve this misfiring, as an increasing 'value at risk' at this rate would make risk management appear unsuccessful:

> *"We have a problem, a real problem. Now that we have so many new risks coming in, we can now see that the risk value is increasing which is because we are adding so many new risks. But that we have trouble managing; that we are having a lot of trouble managing; because we do not believe that it should increase. We believe it should decrease, but because we are dividing the risks a lot, it is increasing… We need to let them work with risks but we cannot do that if we don't allow them to include them, assess them and so, but then the value goes up which we cannot have. It is something process-like-technical-like that goes wrong and we do not have a solution for this yet". Risk Consultant (I12, 341)*

As the quote illustrates, the consultants were confronted with what seemed to be an inherent shortcoming of the practice: whenever large risks were broken down into smaller ones, the aggregated assessments of these added up to be larger than the original assessment. The consultants, though, knew that the answer to this

shortcoming lay not with the control system's calculations but with the new knowledge that the suppliers had brought with them. However, this did not reduce the severity of the situation – quite the opposite. It just proved that risk assessments had been made too low to begin with, and thus it illustrated that the practice was not capable of making exact estimates of the uncertainty the project faced. In addition, the consultants knew from earlier events that increasing risk values without basing it on solid arguments would disprove the predictions of risk management and question its credibility to an unwanted extent. Also, they could not dismiss that the assessments made by the suppliers themselves were biased – on the contrary that seemed likely, as the suppliers had different interests in the project. The consultants, however, knew that the last risk report had been made just before the contracts were signed, so they had at least six months before the next one had to be prepared. This gave them a time window to turn the practice around.

The consultants started to work out solutions. In this respect, the consultants had already for some months had programmers working on improving the management control system to accommodate the increased number of people involved. In the month that followed, the risk management control system was decentralised by switching platforms from an Access controlled database to an online Internet-based tool. This new control system still had the same structure, that is the same core elements, but it had been redesigned to let all risk owners (and more) be given user access. This allowed the risk owners to access the database themselves and then describe and assess risks on their own without having the consultants handle this process manually. The system still contained the cause-and-effect relation description fields, the assessment categories of cost and time, and the risk-reducing action field where risk owners could describe their risks. It also still required risk owners to be selected, deadlines for actions to be made, explanations to be given,

etc., but now users were able to operate the system by themselves, at a distance, and at the same time, which meant that the consultants could concentrate on monitoring and controlling the practice. The new control system further allowed much faster production of status reports and improved the possibilities for making statistics, so it also made the procedures of monitoring and control faster than before.

In the eyes of those involved, this new system was much better to work with, and apart from the situation that some operating systems and some browsers did not function with the system, the misfiring seemed to be handled. It did not take long, however, before the consultants became aware that by changing the system they had lost control over whether the involved actors filled in the fields of the control system loyally and did not game the system. In the weeks that followed, although risk consultants were still managing risk meetings, subprojects and their suppliers were entering either wrong, incomplete or no information into the system. At the same time the deadline for the next status report was approaching, and if this misfiring continued, not only the reported risk value but the entire risk practice would be scrutinised. Thus, contrary to its purpose, the practice had not reduced uncertainty, but rather increased it further, and it was now heading straight down an uncontrollable spiralling path if something was not done. During this period of about three months, the 'value at risk' rose by more than 50 per cent, while at the same time it did not seem as if this development was going to change at all. Figure 7.3 below shows this development for the early design specification phase of the regional lines east and west combined. It continues where Figure 7.2 ended and shows how the 'value at risk' went up from index 0.23 to 0.39.

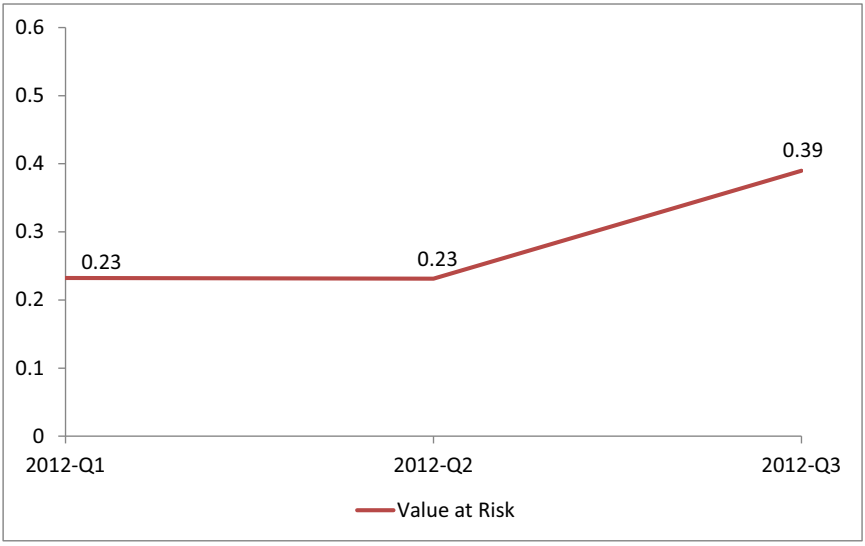

Figure 7.3: The Signalling Programme, Regional Lines (East + West), Design Specification Phase (early): 'Value at Risk' calculation

Furthermore, the rise in 'value at risk' was not made any better by the situation that actual events with negative effects on project objectives had started impacting, despite having been taken into account by the risk management practice. Pihl and Son, a large Danish engineering company, for example, went bankrupt, which sent ripples throughout the construction sector and also led to unwanted time delays and extra costs for some of the larger subprojects of the Signalling Programme. In another example, the main supplier to the mass transit system project had installed a new communication unit on seven trains when one of them started to develop smoke. This led to the immediate grounding of all seven trains and required extensive rework by the contractor, which consequently led to severe delays on the mass transit system subproject. The train operating company that owned the trains further explained that if just one more train had been grounded,

this would have forced them to change the timetable of the entire mass transit system, which, in turn, would have led to a large media scandal and most likely political interference. As this had already been mentioned as a potential risk prior to this event happening, this subsequently led to tensions between actors who started to question the capability of the risk management practice to actually cope with uncertainty regarding suppliers.

The examples above illustrate two of the events that the actors thought had been dealt with by the risk management practice, but which now created new and unexpected uncertainty about the capability of risk management. In the first example, the involved actors questioned whether these events with great impacts but low probabilities, such as bankruptcies, could actually be caught by risk management practices; and in the second example, project managers started questioning the capability of risk management to deal with supplier-related risks as such risks were outside the direct control of the Signalling Programme. This latter question arose even though the exclusion of such risks was clearly consistent with enterprise risk management in being outside the scope of 'the enterprise'. The world created by enterprise risk management had thus begun to crumble, and new uncertainties emerged that originated both from concerns held by involved actors and from outside events. The risk consultants and programme management knew that something had to be done to stabilise the practice, which, referring to the increasing 'value at risk', meant to put an end to this development.

7.7.5. The stabilisation of the predictions of enterprise risk management

One of the first actions taken by the consultants with the acceptance of the consultancy conglomerate, which had now been forced into being part of the misfiring, was to increase the number of risk management consultants dedicated to the pro-

ject. In the months that followed, three more consultants were appointed to handle the subprojects, including the large number of smaller subprojects, and the suppliers were also asked to appoint their own risk management responsible representatives. These appointments were made to solve the problem that the subprojects were not providing proper risk information. The new risk consultants were given the job of overseeing the management control system information that was entered into the system, arranging more risk meetings and workshops, and assisting the project managers as best possible by providing them with feedback information on the risk management progress. In the beginning, this helped stabilise the information that flowed into the system, as it forced the involved actors to produce the information in a way that was consistent with the control system structure. This, however, still did not resolve the situation of increasing risk values, as the risks that were entered into the system were still very technical and accurate and thus represented justifiable risks as prescribed by the practice.

In dealing with this, the consultants had been considering how they could re-establish their control of the practice while still maintaining the new, decentralised risk identification and assessment structure that came with the new control system. They then came up with the idea of dividing the concept of risk into "overall risks" and "sub-risks" while still adhering to the programme definition of risks as "events with positive or negative impacts on programme objectives". They defined "overall risks" as those risks that affected the programme level of the project and thus programme objectives, while "sub-risks" were defined as risks that affected the subproject level of the project and thus sub-project objectives. As programme management only wanted to know about those risks that affected programme objectives, this allowed them to exclude "sub-risks" from the risk reporting. In the risk management control system, this further allowed them to exclude "sub-risks"

from risk calculation, which meant that they could be excluded from the concept of 'value at risk'. In practice, the consultant team would now ask suppliers and project managers whether risks would have overall programme effects, and, if that was not the case, classify them as "sub-risks". In consequence, as "sub-risks" still existed inside the control system, this allowed risk consultants to prepare monthly status reports on such risks to project managers, and still be able to exclude them from calculation.

Another problem persisted, however; the project managers and suppliers were still able to add risks on their own and thus bypass the new concepts – which they often did. This led the consultants to introduce yet another risk concept distinction, which they called "approved" and "under review" risks, and this was to have wide consequences. As the terms indicate, approved risks were those risks that had been approved and thus included, while under-review risks were those that were pending, awaiting approval. In the months that followed, this solved the problem of increasing risk values, and the practice was stabilised again to the effect that it was able to produce the results prescribed by enterprise risk management. This means that the practice was again able to produce reducing risk values, as these, as mentioned earlier, represented the generated level of relative certainty. Figure 7.4 shows the development of the 'value at risk' curve for the whole design specification phase just before the suppliers began adding risks (2012-Q1); how the risk value increased after suppliers had come aboard, but before new risk concepts were developed (2012-Q2); how these new concepts were enforced and 'value at risk' again began to decrease (2012-Q3 – 2013-Q2); and how the practice ended up being stabilised again (2013-Q2 and onwards). The red line shows the formally reported indexed values, which refer to those risks that were 'approved' and

'overall', while the blue line refers to those risks that were both 'approved' and 'non-approved' as well as 'overall' and 'subproject'-related.

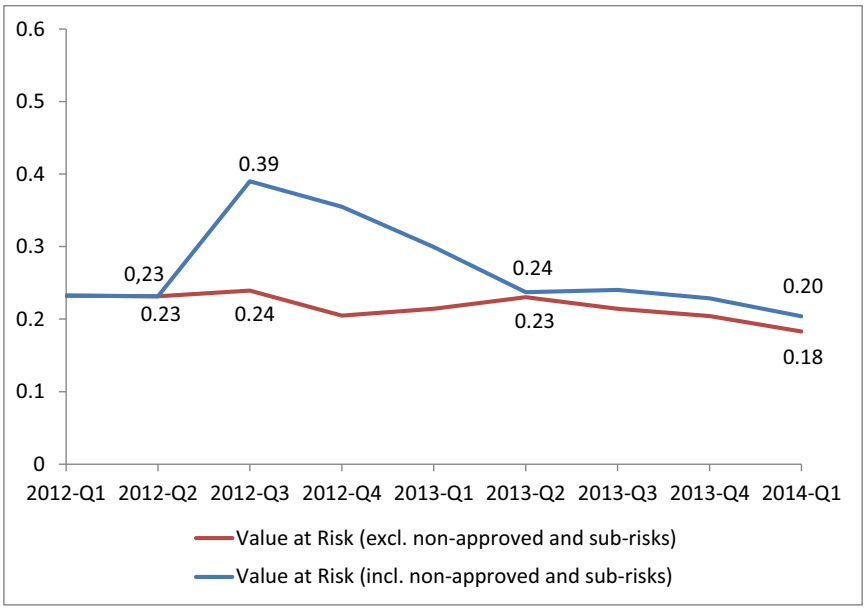

Figure 7.4: The Signalling Programme, Regional Lines (East + West), Design Specification Phase (whole): 'Value at Risk' calculation

It took more than developing new concept distinctions, however, before the development could be turned around; the concepts also had to be *used* by the people involved. In making sure of this, the consultants had the programmes incorporate the new risk terminologies into the IT-based control system by creating new boxes where these options could be ticked. The consultants then applied this new system structure on all risk meetings, so the participants would be confronted with them on a day-to-day basis. In these meetings, this happened because the consultants made sure to demonstrate the system to the participants on a projector screen at

the back wall of the meeting room. This happened without exception. The participants could then visually follow how their oral descriptions were translated into written words that fitted the system fields and ticked boxes showing their choices. The consultants would be the only ones operating the system, and they would settle all discussions about risks that did not fit this structure by referring to the system categories. It was evident from the many observation studies that this had an enormous effect. The participants described that this helped them "to understand what it means to do risk management", something which became less and less relevant as the project progressed, which shows that this embedding of the new risk terminologies had decisive effects.

In collaboration with programme management and the head project managers of the different subproject, the consultants decided to let the two end-to-end managers from the three main subprojects handle the subsequent approval/non-approval of the risks. These two people were the two overall project managers responsible for the regional lines (east and west) and the mass transit system subprojects respectively. In the period from 2012-Q3 and onwards, this principle was gradually being established and included organising regular risk approval meetings every second month, where decisions were made whether to approve or reject risks. The consultants would prepare lists of approved and non-approved risks, and they would discuss them thoroughly. The risks that were accepted would be returned to the project managers with the go-ahead to continue their risk reducing work, while the risks that were rejected were returned with comments on either to elaborate more on the description, or simply that the risks had been rejected. If this happened, however, the project managers could still add these risks as "sub-risk", but then they would be excluded from calculation and reporting and thus not be re-

ported further up in the organisation. This exercise was necessary in order to still being able to deal with those risks that were included outside risk meetings.

The consultants also had to readjust the work-flow practices of all the involved actors. During this period, the consultants started to write new descriptions of these practices. One of the important parts was introducing three new layers of risk management into the practice: the discipline, the project and the programme management level. The discipline level consisted of the employees working on the subprojects who were now responsible for owning the risks and their risk reducing actions (unless the subproject was too small). The project level consisted of the project managers and the newly employed extra consultants who would participate in risk meetings together with those discipline managers who had identified or owned the risks. These risks would then be brought to the programme management level, where an appointed head risk consultant would meet with the end-to-end managers and/or programme management, as described above, to approve or reject the risks. To avoid too much information in programme level meetings, however, the project level risk consultants would pre-assess the discipline or project managers' descriptions and coordinate with them if changes were needed, in accordance with the new system structure. In all of the three layers, anyone could thus enter information into the control system using their user access rights, which were distributed to them through the system, but only the programme level had the highest level of access.

The consultants, however, were now struggling with the inclusion of still more risk owners now that discipline managers had been included; these managers were unfamiliar with the structure of the practice (as were still many of the suppliers). In addition to operating the control system in the meetings, the consultants there-

fore decided to supplement this by producing training pamphlets that could be distributed outside meetings, giving the discipline managers (and suppliers) information on how to approach the practising of risk management. This material explained their roles as risk owners, how to formulate descriptions according to the cause-and-effect logic, the assessment categories, and the importance of doing risk-reducing actions. The consultants would then meet (this was not written) approx. every second month to coordinate the progress of the practice and catch potential misfires before they happened (again). The consultants also had programmers add new auto-reminder functions to the control system to ensure that the participants did not forget their responsibilities; the system would now send out email reminders on the status of risk actions two weeks before their deadline (O33, 10).

In the months that followed, the practice was stabilised again, and the actors were producing risks that adhered to the conditions established by enterprise risk management. The risk consultants were again able to produce decreasing risk values as postulated by enterprise risk management. Substantial investments had been spent on redeveloping the control system, employing more consultants, producing training material, increasing the number of meetings, etc., but the conditions had been re-bracketed. At present, the practice continues to produce consistent and decreasing 'value at risk' curves, also between meetings. Approval managers still rely on risk approval meetings, but their workload is reduced as risk owners produce increasingly consistent descriptions and assessments. At the same time, programme management and project managers alike commend the practice and the certainty it has added to the objectives of the project. The strategic centre expects that the project will meet its objectives and to be able to hand over the project without any delays or incurred costs.

7.8. Concluding discussion

This paper has responded to the call for more research into "the particularity of risk management characteristics in specific organizational settings" (Bhimani, 2009, p. 4) and the "dynamics of risk management" (Mikes, 2009, p. 37). I have looked in more detail into the linkage between enterprise risk management and a practice of risk management constructed around this while adhering to worldwide "best-practice" holistic risk management (Power, 2007). This practice was implemented as a project management control system to provide "reasonable assurance" regarding project objectives (Transportministeriet, 2008). I have observed this practice 'in action' and looked into how it was configured and readjusted over time as events emerged which threatened the practice from meeting its objectives. The following section summarises the findings of the study, while drawing more explicitly on the concept of performativity, and looks into the theoretical and practical implications of the findings. It emphasises the different conditions needed for enterprise risk management success, in particular during times of misfires, and stresses the importance of continued mutual adjustment between risk linguistics, identities and IT-systems to achieve success in practice.

7.8.1. The performativity of enterprise risk management

This paper began by showing that through enacting certain realities of 'risk' and 'risk management', enterprise risk management enabled production of the risks that confirmed its success. This happened primarily because the consultants who had been contracted to operate the practice configured the practice along the guidelines of the PMBOK enterprise risk management framework which was considered "best practice". The consultants defined risks as 'uncertain events with either positive or negative impacts on project objectives' and risk management as

'the practice of managing these risks'. The consultants also defined the purpose of the practice (to provide reasonable assurance for the objectives of the programme), its main processes (identification, assessment, response and control), the roles of the actors (e.g. project managers as risk owners), the overall governance structure (programme board/management ownership, reporting formats, meeting types and frequency), risk categories and documentation requirements (project phase, risk type etc.), identification and assessment techniques (cause-and-effect meta-language and traffic light assessment matrix), and implemented the calculating metric ('value at risk'). The consultants thus configured the rhetorical boundaries of practice, drawing upon linguistics from the "best-practice" enterprise risk management vocabulary, which from the early stages of the project ensured the unproblematic approval and acceptance of all involved actors.

In this paper, however, I have also shown that the configuration of the practice depended on more than just linguistic boundary-setting acts, or "discursive practices", such as those of defining, limiting and expanding the world of risk management (Mikes, 2011). I found that the material assemblage, consisting primarily of the IT-based control system with its calculating metric and distributed status reports, also had a part in configuring the practice. The control system was significant, because the consultants embedded the rhetorical configuration of the practice into the control system and applied it in all risk meetings. In this sense, the control system was visible on a large projector screen on the back wall of the room where the meetings took place, to allow all participants could watch it, and because the consultants were alone in organising the meetings, and also in operated the control system (at the beginning of the project), they were able to ensure that only the information that fit the configuration was included. Overall, this allowed the consultants to bracket out this particular world of risk management in order to enable

the predictions of enterprise risk management to come true, that is, to make enterprise risk management performative.

In the first few years of the project, the involved actors adapted their production of risks to the configuration of the practice, which is evident when looking at the actual content of the risks, their assessments and the actions taken to reduce them. Consequently, it did not take long before the consultants, drawing upon the information in the control system, were able to demonstrate the success of enterprise risk management through a decreasing 'value at risk' curve, which, in turn, further reinforced the adoption of that world. In this relation, Mikes (2009, 2011) argues that the reliance on either analytical or judgemental information systems depend on top management's predilections for *either* quantitative enthusiasm or scepticism. In this paper, I have found that the strategic centre supported the robust and hard nature of modelling (the 'value at risk' curve), thus being so-called quantitative enthusiasts, while at the same time they distrusted this, which made them also quantitative sceptics. In explaining this apparent paradox, I found that the strategic centre was driven more by the precepts of enterprise risk management rather than their individual preference for either quantitative enthusiasm or scepticism. In this sense, they took the *relative* development of the 'value at risk' curve as hard evidence of the status of the project (not just as a trend), while at the same time acknowledging that *absolute* values were unreliable as an expression of any underlying economic reality; they were rather best guesses.

In elaborating more on this, I found that the day-to-day practice of risk management could not be understood by focusing on top management or consultants alone, but had to be understood by considering *all* actors. This because the strategic centre did not have reliable statistical data sets and relied on the judgements of

project managers, suppliers, discipline managers, and others, to provide descriptions and assessments of risks. This meant that all actors were able to influence how uncertainties were described and assessed; all calculations were subject to judgement, as all "numbers were narratives" (Vollmer, 2007). In addition, these actors held different measurement attitudes, ranging from the strategic centre being the most enthusiastic to project managers being the most sceptical. Here, Mikes did not exclude the possibility that "alternative cultures could co-exist within the same organization" (2011, p. 242), but she questioned whether this was more than a theoretical possibility. In the present paper, I have found that the practice managed to make these different "alternative cultures" co-exist without disrupting its smooth operation. The following quote from a consultant serves as an explanation of why this was the case: "we could all agree that values should decrease over time" – an assumption which 'enterprise risk management' states repeatedly.

Other researchers have demonstrated that the basic conception of current "best-practice" risk management as being able to take all material uncertainties into account is flawed to the extent that risk management may end up generating new uncertainties (Power, 2009; Vinnari & Skærbæk, 2014). In this paper, I contribute to this discussion by showing that it is exactly because of this production of uncertainty, which comes with the framing of any practice (Callon, 1998c), that the practice enables the production of certainty. We are indeed "acting in an uncertain world" (Callon et al., 2009), meaning that there are a lot of things that we know we do not know, but it is because of this knowledge that we adopt frameworks to help us get an overview of uncertainties and make them manageable. I have shown that it was because the practice adopted enterprise risk management that they became equipped to produce a decreasing 'value at risk' curve and generate certainty

for the strategic centre, and because the practice concretised the meaning of 'risks' that project managers gained certainty regarding their ability to act on them. This might then produce new uncertainties, but this just goes to prove the usefulness of inaccurate models (Millo & MacKenzie, 2009). It is the bracketing of the world that enables, but also limits, the production of certainty and uncertainty.

7.8.2. The misfiring of enterprise risk management

In the first three years of the project, the practice performed enterprise risk management according to its precepts with success for most involved actors. However, the contribution of the present paper goes beyond establishing that theories, programmes, devices, etc. can have performative effects. This has been demonstrated elsewhere in the accounting literature to be the case, just outside the realm of risk management (e.g. Cushen, 2013; Dambrin & Robson, 2011; Skærbæk & Tryggestad, 2010). These papers have shown how accounting devices such as budgets and performance measurement systems shape the practices they were meant to describe, which has sometimes created unexpected effects. The contribution of the present paper is to show how performativity can be re-stabilised during times of performativity misfires, as well as the conditions under which this can take place. This has been described both in and outside the accounting literature as something that we lack knowledge about (Butler, 2010; Callon, 2010; Dambrin & Robson, 2011), which requires following how this happens before, during and after the relevant period of time (Ferraro et al., 2005; MacKenzie, 2006). This section follows up on the analysis sections that have dealt with the misfiring of enterprise risk management and how the practice dealt with this misfiring.

From the very beginning, the strategic centre dealt with concerns that were mainly put forward by project managers who were worried about whether there would be

any benefits from doing risk management. Vinnari & Skærbæk (2014) and Arena et al. (2010) have argued that the practice of risk management may compete with other practices or other actors' work responsibilities. In this paper, I have shown that project managers expressed concerns about whether risk management was relevant and whether it was feasible, and also that local practices sometimes emerged to complement the formal practice. This goes to confirm Vinnari and Skærbæk (2014) and Arena et al.'s (2010) finding, and I argue that this might be an area for further, more systematic research. In this case, those concerns were settled when risk consultants engaged in dialogue and debate with the managers who expressed them in order to ensure their successful enrolment. It was not until the onset of outside, unforeseen events that enterprise risk management misfired. The misfiring happened during 2012 when the suppliers were included into the practice, because the practice continued to adhere to the precepts of enterprise risk management (they defined its basic conception, the procedures, definitions, devices etc.), while the 'value at risk', rather than decreasing, began to increase dramatically, while enterprise risk management had postulated the opposite relationship. In re-quoting MacKenzie (2006)'s definition of counter-performativity: enterprise risk management made the practice less like its depiction by enterprise risk management, which began to question the logic of enterprise risk management.

In dealing with this, the present paper has demonstrated that in times of performativity misfires, the risk management control system became the all-pervasive actor through which the conditions of performativity success were stabilised. This technology allowed a re-definition of terminologies and re-distribution of responsibilities, which in turn allowed the practice to overcome the misfire. This was evident because the practice could not be stabilised until the consultants, with the approval of programme management, decentralised the IT-based risk management control

system, which allowed more actors to be involved. This was not enough, however, as 'value at risk' still increased, but when terminologies were expanded and new roles distributed, and most importantly, when these changes were incorporated into the control system, the practice re-stabilised and the 'value at risk' began to decrease as the project progressed. In practice, this happened because the notions of "approved" and "non-approved" risks and "sub-risks" and "overall risks" were incorporated into the control system, which managers were confronted with on a daily basis. Also, new responsibilities were given to actors: end-to-end managers were made risk approval managers, four new consultants were made risk experts, and discipline managers were included as risk owners. In combination, these changes were communicated through training pamphlets, a revised strategy document and organisational work-flows figures, and exhibited on regularly held new meeting types.

In contributing to the current debate on the conditions of performativity (e.g. Ferraro et al., 2005, 2009; Callon, 2007), the present paper demonstrates that language (new risk terminologies), social norms (acceptance of the practice) and institutional arrangements (fixed meetings, work processes etc.) are important, but inadequate elements. In times of performativity misfires, technologies or calculative devices (the risk management control system) become the most important elements for re-stabilising the prediction of enterprise risk management and thus its success. This finding was evident from the observation that the IT-based risk management control system became the mediator between all communication, all status reports, all descriptions, all assessments, all actions and all 'value at risk' calculations, thus, this device mobilised the entire practice. This implies an intrinsic linkage between language, identities/roles and material assemblages, where technology as part of the material assemblages are drawn upon to shape the language it

helps to enact. This technology, i.e. the control system, transformed the strategic centre who proposed the original risk language, to the effect that they ended up believing in the "new" language, which in turn gave them a higher degree of certainty concerning the programme objectives. And this happened at the same time as the project managers, relying more on the day-to-day relevance of the practice rather than 'value at risk' or any other language, also came to believe this as they trusted the consultants as the experts who knew what was best.

In contrasting this to Callon's dual notions of framing and overflowing, technologies become the important device through which performativity can be achieved when dealing with what Callon termed 'hot' situations (Callon, 1998c, p. 260). In 'hot' situations, the actual list of actors and their identities will fluctuate; the way effects are measured will become controversial, and "facts" and values become intertwined. It is those situations in which the framing of the world itself comes under critique; it is when the "possible states of the world" open up again and the bracketing of the world has failed. In the present paper, I have shown how the misfiring gave rise to the questions of who the risk owners were, how to calculate 'value at risk' in future, how to maintain control with the practice, etc. Here the strategic centre had "to take action in order to produce an officially recognized body of knowledge" (Callon, 1998c, p. 261) – which they did by reframing the language, roles and technologies. The consultants had to find a way to re-bracket the world to match its precept with 'enterprise risk management' to allow progress to be demonstrated again, progress which without a stabilised frame would simply serve to illustrate a higher level of uncertainty, which was unacceptable.

At the end of the examined period, the practice had been re-stabilised according to the precepts of enterprise risk management, and 'value at risk' calculations

showed decreasing values-at-risk. This indicates that the above taken actions regarding reconfiguration of the risk management control system, redefinition of risk terminologies and redistribution of identities managed successfully to realise the predictions of enterprise risk management. It should be noted here that I followed the practice throughout the remaining part of 2013 and into 2014, and the practice still produced decreasing risk values. However, as the project runs until 2020/21, many things may still happen, and there is no guarantee that the practice will not again incur another 'hot' situation. This illustrates Callon's (1986) point that all framings are temporary and that stability is a cost investment to achieve.

7.9. Future research and limitations of the current study

In relation to future research on risk management, it is argued by this paper that more attention should be given to the performative role and effect of technologies, in order to understand the linkage between enterprise risk management and practices of risk management. The present paper has explored this linkage, focusing on enterprise risk management and one large infrastructure project, and thus it cannot present conclusive findings on other projects – or other organisations. It also follows that large infrastructure projects are often prone to new and unexpected uncertainties, as they are often unique and thus depend on judgement calls by managers. In contrast, many other organisations apply large statistical data sets on prior events, which all things being equal makes computing the outcomes of risks and preventing these more reliable. My argument is thus that it would be fruitful for other studies to examine whether enterprise risk management (or any other statement on how to do risk management) may also explain how other practices of risk management end up being configured and subsequently produce and manage risks. It may also make a difference that project managers have for decades prac-

tised risk management as part of good project management, which could have an impact on the constructed practices in other types of organisations.

To argue that enterprise risk management becomes performative is furthermore an empirical question, and this paper has not examined all empirical practices of risk management. It is thus indeed explorative, and more research into this should be conducted to verify whether other practices end up also confirming the precepts of enterprise risk management (at the same time as exhibiting different cultures, for example). Also, the Signalling Programme has been scheduled to be completed around 2020/21, which means that many more translations are bound to incur: will the actor-network examined here expand or retract and thus readjust even more, leading to new interesting developments? Will the programme of enterprise risk management itself even be translated into something else? Many questions arise which cannot easily be investigated. This paper is limited to a case study of a programme in which risk management was implemented for the first time and thus not black-boxed. Others may expand on this research with other types of research; from in-depth examinations to more generalised accounts. This would add to the generalisability of the current findings and might shed even more light on the widespread use of risk management and how performativity works.

This paper has sought to expand further on the conditions of performativity by including the translations occurring around emerging concerns and technologies, hopefully adding to our understanding of the so far relatively unexplored phenomenon of the performativity of theories/programmes. There are, however, other interesting areas related to risk management. It has not been examined explicitly here, but it appears that the more narrowly defined concept of risk covers only part of the larger concept of uncertainty. In relation to the concept of knowledge, this

could be interesting, because if only uncertainties made calculable, or risks, are considered knowledgably, some uncertainties which cannot be made knowable in the same way are excluded. Softer forms of knowledge, such as feelings or hunches, are excluded, but it is a question whether that is in the best interest of the project when it runs over a longer period of time, when the context surrounding the project itself is bound to change several times. If we further take into account that "the context", the environment changes over time, this seems to be something that cannot be taken into account, as it requires that something has happened before it can made calculable and thus knowable.

8. Risk management and uncertainty in large infrastructure projects: What roles for knowledge and project management?

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8.1. Abstract

Risk management devices and practices are routine parts of delivering large infrastructure projects. Risk management places emphasis on quantifying risks and developing strategies to manage, control and mitigate them. This means that the contribution by the on-going production of knowledge during project processes is limited; instead, knowledge is positioned as upfront input to planning and specification. However, infrastructure projects are often characterised by long durations, by involving many actors at different stages, and by a high degree of uncertainty, ambiguity and complexity. This presents a problem for both risk management approaches and project managers: How can uncertain future conditions and unexpected events be reconciled with rational approaches to risk management? How is the production of new knowledge during project processes incorporated into risk management practices? What effects do risk management practices have on the on-going project? To address these questions, we draw upon two comparative case studies of large Danish infrastructure projects, using Callon's (1998a) dual notion of framing and overflowing. The cases demonstrate the emerging uncertainties that challenge project and risk management objectives as new knowledge about the conditions are produced during project processes, and describe the activities of project actors to both perform risk management as required, but also manage emerging uncertainties and concerns. We conclude that dominant risk management approaches neglect the wider range of uncertainties that emerge during project processes and that overreliance on these approaches threaten the long-term value and effectiveness of the project.

Keywords: Risk management; uncertainty; knowledge; infrastructure; project

8.2. Introduction

> *"The [ideal knowledge] conditions required for it to be relevant to talk of risk are not met. We know that we do not know, but that is almost all we know: there is no better definition of uncertainty". (Callon et al., 2009, p. 21)*

The assumption that large complex projects should be managed in order to reduce uncertainty and increase predictability is not new. What is relatively new, however, is that uncertainty reduction can and should be obtained through formal risk management approaches. We question both assumptions by addressing a more fundamental question about the role of knowledge in current risk management practices. Our argument and claim are that predominant generic risk management approaches tend to reinforce conventional ideas of project control whilst undermining other notions of value and relevance of built assets and project management processes. These approaches fail to consider the role and potential value of knowledge production during the project process, instead seeing knowledge as input to upfront planning and specification. However, relatively little research has been done on the effects of generic risk management approaches in complex infrastructure projects. We examine ways in which actual project practices approach the question of risk management for the cases of large public hospital construction and infrastructure projects in Denmark. These projects are characterised by long durations and by involving substantial materiality, high uncertainty, ambiguity and complexity. Yet, they are also subjected to risk management that operates according to a generic 'best practice' control approach – as if these hospital and infrastructure projects are quite simple, predictive and similar in nature. The cases reveal the emerging uncertainties that challenge the project plan and the risk

management approach as new knowledge about the conditions are produced during the project processes.

In the next section we open up our inquiry by accounting for the predominant approaches to risk management according to the literature. We also position our own approach, being inspired by contributions to management and organisation studies, and more specifically by Actor-Network Theory (ANT). Next, we account for our case method. In the section that follows, we expand our study by inquiring into risk management practices in large infrastructure and construction projects and reveal their assumptions about knowledge and the ramifications these assumptions have for project and construction management. The cases reveal the emerging uncertainties that challenge the project plan and the risk management approach as new knowledge about the conditions are produced during the project processes. The paper concludes by proposing a more dynamic understanding of the role of knowledge, considering the practical implications of uncertain knowledge conditions as a prevailing condition for project and construction management rather than as something to be known in advance and reduced by risk management.

8.3. Uncertainty and risk management according to the literature

During the last two decades, scholars in management and organisation studies, sociology and economics have developed a renewed interest in the concept of risk, dealing with classical notions such as gambling, occupational and operational risks, as well as more recent and encompassing notions such as 'risk society', 'world risk society' (Beck, 1992b, 1999), 'enterprise risk management', and 'the risk management of everything' (Power, 2004). Gephart et al. (2009) argue that risk has been a neglected topic in organisational studies and that organisational theory "tends to omit consideration of risk or relegate it to the status of unintended

consequences" (Gephart et al., 2009, p. 152). According to Power (2004), ideals about more and better control underpin the recent expansion of risk management practices across organisations and societies. Best-practice approaches to project management have long since promoted control and more recently extended the control with risk management. A key role and responsibility of project management is to ensure ongoing monitoring and control so that the project can be executed efficiently and accurately and delivered according to predictions. That is, according to a pre-set goal and plan (Flyvbjerg, 2006; Turner et al., 2010). The reduction of uncertainty to ensure execution according to this pre-set goal and plan is integral to the control ideal in 'best-practice' project management, and risk management is one of the most persuasive additions to this control.

In the same period, an increasing number of scholars in project research have addressed a number of critical issues and limitations associated with uncertainty reduction and control, such as: the project's lack of effectiveness and loss of relevance in the wider stakeholder environment (Kreiner, 1995, 2014), the lack of a broader value-orientation (Morris, 2010), and the reduction of robustness and reliability in organisational performance due to a false sense of control and certainty (Coutu, 2003; Weick & Sutcliffe, 2001). A key argument across several contributions concerns the conditions of knowledge in temporary project settings. Kreiner (1995), Lundin and Söderholm (1995), Engwall (2002), Jönsson (2004), Atkinson et al. (2006) and Lindkvist (2011) have all emphasised the contextual complexity, uncertainty and ambiguity of temporary project settings. Alongside these conditions, van Marrewijk (2007) noted the prevalence of rituals and cultural values governing mega-infrastructure projects, and Winch (2010) noted the existence of wicked problems, that is, problems that are uncertain in the sense of being ill-defined and without an optimal solution. In brief, then, the conventional control

approach to projects and project management has been drawn into question for being reductionist when dealing with uncertainty, biased in favour of predictability and efficiency in execution while disregarding the project context and longer term perspective after the project has been handed over and its results put to use.

The distinction between uncertainty and risk is integral to the above discussion. As noted by Chapman and Ward (2011), uncertainty management can be better than risk management insofar as the former implies further consideration of potentially favourable opportunities, benefits and outcomes, in contrast to the more limited notion of risk management, which tends to deal with the unfavourable costs and outcomes. However, as also noted by Power (2004), there seems to be more to this distinction. When the economist Frank Knight (1921) introduced the distinction between uncertainty and risk, it was, according to Langlois and Cosgel (1993), to address a more fundamental uncertainty that went beyond assigning probabilities to more or less favourable outcomes. Knight here reserved the notion of 'risks' to events "susceptible of measurement", meaning those events that we at least knew about in order to be able to classify their outcomes (Knight, 1921, p. I.I.25). In contrast, uncertainties referred to unmeasurable events, that is events of knowledge and conceptual categories that are unknown due to "the impossibility of exhaustive classification of states" (Langlois & Cosgel, 1993, p. 459). Thus, according to a Knightian distinction, the concept of uncertainty is broader in scope and implication than the concept of risk – while the latter can be subjected to quantification and calculations, the former must be dealt with by judgement and intuition.

Winch and Maytorena (2009, 2011) note that the distinction between uncertainty and risk was introduced into management and organisation research by the semi-

nal work of James March and Herbert Simon and the Carnegie School. March and Simon (1958) questioned the contemplative 'cold' cognitive bias of much previous work on decision-making in organisations, especially associated with rational choice and subjectively expected utility theory. They argued that the simple model of a 'superhuman' rationality (cf. March & Olsen, 1975) should be replaced by a more nuanced and modest model of limited human cognitive abilities, or what they termed 'bounded rationality'. They argued that this would to be closer to the empirical reality of organisational decision–making, which was characterised by limited knowledge, incomplete and ambiguous information, unawareness of all alternatives, unstable and hard-to-define preferences, and conflicting and ambiguous goals and objectives.

Simon (1983), building on that work, further proposed a model based on intuition and emotion, shifting attention from cold to 'hot cognitions'. Hot cognitions are related to the positive outcomes that surprise and sudden discovery can bring about, as well as the excitement they provoke. March (1971) similarly describes 'technology of foolishness' and distinguishes between exploration (of yet unknown and hence uncertain worlds) and exploitation (within a relatively well-known universe). March argued that the technology of rational choice is biased in favour of exploitation as it tends to assume perfect knowledge and given (exogenous) goals. He proposes a technology of foolishness, because it encourages the (endogenous) exploration of new knowledge, including the possibilities of achieving more exciting goals. Serious matters like knowledge production and learning, innovation, new visions, goals and decisions can be facilitated by a technology of foolishness – by expanding outside the cognitive limits of rational choice.

Some more recent contributions have also addressed possible complementary perspectives on uncertainty and risk management. Flyvbjerg (2006, 2008) points to the usefulness and importance of better budgeting accuracy through the implementation of 'reference class forecasting', which includes systematic risk management in order to ensure better control with and predictability of large complex infrastructure projects and their outcome. In contrast, Corvellec (2009) draws attention to the usefulness of silent, non-explicit and non-formalised risk management practices, and also Millo and MacKenzie (2009) point to the usefulness of focusing on inaccurate models and methods rather than on methods of improved accuracy. According to them, the success of a forecasting method can depend on its usefulness in practice and thus be independent of the method's more or less predictive powers and expert knowledge. For example, organisational actors may adopt a particular forecasting method because it helps them to make fast and efficient calculations and decisions, and in turn justify those calculations and decisions, as well as to communicate with others about issues of mutual interest. This is a rather different utility than the classic argument about making reality and the project more certain by improving the accuracy of project management methods.

In the accounting literature, three studies have further looked into the distinction between uncertainties and risks. Vinnari and Skærbæk (2014) found that a Finnish municipality's practice of risk management in addition to reducing uncertainty also ended up producing new uncertainties that would otherwise not have emerged; Miller, Kurunmäki and O'Leary (2008) found something similar when they showed that due to their narrow focus on "enterprise risks", two practices of enterprise risk management ended up neglecting the wide range of uncertainties emerging from outside organisational boundaries; and when looking into one mega-project's practice of risk management, Themsen and Skærbæk (2014) found

that only some uncertainties could be constructed as risks while others were excluded because the technologies invented to capture them operated with criteria that excluded them. These excluded uncertainties were still held as risks by local managers, who consequently tried to cope with them by inventing local practices using their own risk devices. As these local managers had neither the time nor the resources to deal with these risks, and because the risks did not get any management attention, they were in effect, however, often not dealt with at all.

8.4. An actor-network perspective on risk, uncertainty and knowledge

Although the work of March and Simon is useful to identify forms of rationality beyond the objective, we contend that an understanding of risk and uncertainty requires more that the consideration of objective, cold rationality on the one hand, and more subjective, emotive or hot rationality on the other. Risk management practices do not merely draw on different underpinning rationales to produce knowledge, they actively construct and reproduce approaches, techniques and tools that, as argued by Corvellec (2009) and Millo and MacKenzie (2009) above, may or may not claim to reduce uncertainty or quantify "real" risks. In order to further explore this, we draw on actor-network theory and the work of Callon, particularly the twin notions of framing and overflowing.

Callon (1998a) draws on Goffman's concept of the frame – the establishment of a boundary around a particular set of interactions or activities, along with a shared set of expectations, rules and artefacts which define the contours of the particular setting. But rather than seeing this as a process of separating what is inside the frame from what is outside, Callon (again, following Goffman) describes how the act of framing relies on the connections between frame and external environment, on the network of interdependencies with the outside world. Goffman's example

of the theatrical performance relies on a set of understandings of what audience and actors should be doing (the rules), on the physical framework of stage and props, and on sets of devices to prompt actors, the audience and others (raising curtains, dimmed lights). These things maintain the framing, but also the connection to the outside.

Framing is consequently a process that it requires resources and effort to maintain, but which can never be fully closed off from the outside. Overflows are therefore always present, 'irrepressible and productive' connections leading across the frame's boundaries. Callon discusses two approaches to understanding framing; one in which the frame is considered the norm, and overflows are exceptions to be contained and managed, and one where framing is a more tenuous and problematic (and expensive) activity, and overflows are the norm. The former implies a leaning towards closure, stabilisation and reduction of uncertainty, the latter implies that overflows are what makes the framing successful and productive.

Framing is, then, a process that can lead to further establishment or stabilisation of a body of knowledge or set of practices, but which also in doing so causes overflows of concerns or issues that do not fit within the framing and act to de-stabilise or re-problematise the status of the included practices, knowledge and devices. The concepts of framing and overflowing point to a productive, dynamic relationship where framing produces stabilisation of knowledge, but simultaneously acts as a conduit for overflows, or for re-problematisation.

Alongside overflows, Callon develops the idea of 'hot' and 'cold' situations. Hot situations are those where there are many overflows, where practices and knowledge are contested, and in which non-expert groups can be actively involved

in problematising scientific or expert knowledge and in articulating related issues. 'Hot situations' involve strong emotions and are a response from actors who feel that their emerging concerns about the existing expert bodies of knowledge are ignored, excluded or not sufficiently recognised. This problematises the idea of what constitutes expert (and by implication rational or cold) knowledge as hot situations arise, and suggests that the dynamics of knowledge production can extend beyond boundaries of expertise. A cold situation would be one where there are relatively few controversial overflows, and where practices and knowledge are less contested compared to hot situations.

In terms of knowledge production in the case of risk and uncertainty, the process of framing / overflow implies the possibility of a transformation from a steady state ('cold') situation in which this best-practice body of knowledge is taken for granted by actors, towards a situation in which actors - through their interaction with the devices - starts to problematise and question this risk management knowledge and frame. In effect, such knowledge production becomes distributed, the cognitive processes transgress the human mind and skin, as it implies interaction with different forms of representations of risk, inscribed into risk technologies and devices such as risk registers, risk matrices and risk calculations in spreadsheets, which in turn are circulated in reports and memos that are discussed, judged and evaluated in the individual project organisation as well as across projects in the programmes.

In our understanding, for better or for worse, the emphasis on risk can and should be examined empirically alongside a less instrumental notion of acting and performing within uncertain knowledge conditions. We want to examine the dynamics and effects of risk management and uncertain project conditions in order to go

beyond the contours of best-practice, rational notions of risk management. We draw on Callon and the concept of framing and overflows, as we do not see there is a choice between either rational notions of knowledge or more exploratory, hot or foolish approaches to understanding risk and uncertainty. We see rational and instrumental devices such as risk tools as particular framing devices, which through their actions produce different types of overflows and new, emerging concerns in dynamic processes of stabilisation and re-problematisation. In doing so, we account for this active role of technical risk devices in the production of knowledge and emergence of concerns in framing and problematising emerging issues and unpredicted uncertainties.

Below, we present empirical material from studies of two large infrastructure projects in Denmark; the Danish hospital construction programme, which represents one of the largest public infrastructure investment in the country with a capital budget of DKK 41.4 billion, and the 12-year, DKK 23.7 billion Danish rail signalling infrastructure replacement programme, also one of the largest projects to be undertaken. Both cases illustrate the complex interplay between risk and uncertainty in large projects as well as the tension between risk management producing knowledge about project conditions 'out there' and risk management performing and reifying those conditions. In the context of our work, we focus on risk management practices in projects, but complement this with a particular focus on the possible complex dynamics and exchanges between a more or less uncertain project condition and the risk management practices that are used to manage those uncertain conditions. More specifically, we ask the following question: How do risk management practices shape project conditions for large infrastructure projects, and what are the ramifications for knowledge and project management roles?

8.5. Method

In this paper, we draw on two comparative case studies of large infrastructure projects in the Danish public sector. Both cases are on-going in terms of data collection as the projects are still running. The first case relates to the construction of 16 large hospitals, in the following called the Hospital Programme, which represents a complete structural overhaul of the entire Danish healthcare sector over the next approx. ten years. This series of related projects involves one of the largest Danish infrastructure investments to date in Denmark, which implies a high degree of uncertainty regarding the achievement of its objectives. The Hospital Programme has a budget of DKK 41.4 billion, which is further broken down into a budget for each of the 16 hospital projects and runs from around 2008-12 to 2018-23 depending on the individual hospital construction project. In comparison, the second case relates to the total replacement of all Danish railway signalling, named the Signalling Programme, which represents the largest single capital investment to date in the Danish public railway sector. The Signalling Programme has a capital budget of DKK 23.7 billion and runs from 2009 to 2020/21. It consists of several small subprojects making up three larger ones: the regional lines west, the regional lines east and the Copenhagen mass transit system. These projects will be introduced in more detail in the analysis section.

The Signalling Programme case relies on different information tracing techniques. It relies on the collection of written documents such as government white papers, consultancy reports, auditing reports, risk status reports and project status reports. It also relies on real-time access to the implemented IT-based risk management system that records the descriptions and assessments of risks-related information. This includes “outputs” from that system, such as risk overview lists broken down

according to individual risk owners and 'value at risk' charts demonstrating the estimated summed up cost effect of all risks over time. This material has served the purpose of reconstructing the activities and events of the programme and has also been a source to understanding the formal decisions taken. Another source of information comes from 19 semi-structured interviews conducted with key actors of the programme. The interviews served to get a better understanding of the workings of risk management, the discussions leading up to the formal decisions taken, and the concerns that emerged. Lastly, the case also relies on observation studies. In the course of the period under study, more than 40 observation studies of an average duration of approx. 1½ hours have been carried out, of more than 70 different people involved in risk management, most of them on more than one occasion. These observation studies served the purpose of following day-to-day risk management interaction, following how uncertainty was translated into risks and how knowledge was produced. In sum, the Signalling Programme has been followed from the political decision to go ahead with the project although observations and interviews have "only" been carried out over the last 4 years when the programme entered the procurement phase.

The Hospital Programme case relies on the same type of data. The majority of effort has been put into collecting the many formal and informal documents relating to the programme and individual hospital projects. This includes government white papers, consultancy reports, risk reports and templates, power point presentation slides, project description documents and many more. The documentary data is significant, given the extent of public domain reports and media coverage. The case also relies on interviews with actors from the Danish Regions, state client organisation, and environment organisations involved in the design and construction of several of the individual hospitals that are included in the programme,

along with attendance at public and closed meetings with project management, and documentary data. In total, the data comprise four public meetings lasting between 1 - 1.5 hours, one industry seminar on the hospital programme lasting approx. 2 hours, three industrial conferences on the hospital programme lasting between 4 – 7 hours, nine closed meetings with representatives from the hospital projects and the regions lasting between 1.5 – 4 hours. In contrast to the Signalling Programme, the authors have yet to negotiate real-time access to the risk management databases of the hospital programme. However, both cases benefit from a diverse set of empirical materials such as risk estimates in spreadsheets, written risk guidelines, reports, interviews, meetings and informal conversations.

Having conducted two in-depth and longitudinal case studies using observation studies, document analysis and interviews, we are able to examine actual practices of risk management in their situated setting, following the actors 'in action'. In both cases, observations of risk management 'in action' focus on the issues that emerge as the projects become implicated in negotiating the programme's control and risk management setup. This focus has allowed us to follow and reconstruct the unexpected dynamics and tensions emerging between the programme and the individual projects – something which is important given our research question on risk management practices and the focus on the uncertain knowledge conditions and the role of project management in large infrastructure projects.

8.6. Risk management in practice: the Danish hospital construction programme

This section begins with a brief description of the background for the hospital programme, followed by two sections that account for the development of the risk

management frame and the effects/overflowing and hot situations emerging from that frame.

8.6.1. Background for the hospital programme

In 2007, the Danish parliament agreed with the five Danish regions that the hospital infrastructure needed a "structural improvement" to "achieve the common objective of modern and sustainable health care" (Finansministeriet [Ministry of Finance], 2008). In more detail, the objectives of the project decided on were to improve the quality of patient treatment, reduce operating costs and increase flexible patient treatment. It was acknowledged that this had to be achieved through the construction and operation of fewer but larger hospitals, which would allow improved specialisation as well as better internal working processes and capacity utilisation. In the same year, the Danish parliament and the five Danish regions mutually committed to spending DKK 41.4 billion on these new projects, of which approx. DKK 25 billion were to be funded from a newly created "Kvalitetsfonden", and approx. DKK 17 billion to be funded by the regions themselves. To make sure that the new and improved hospital sector would achieve these objectives, the parliament and the regions appointed an expert panel. In 2008 and 2010, this panel proposed 16 new hospital projects to be constructed, ranging from significant rebuilding and renovation of existing hospitals, over green field projects and university hospitals to so-called 'super hospitals'.

8.6.2. The development of the risk management frame

In the years that followed, the Danish Ministry of Health and the Danish Ministry of Finance both approved the construction of the hospitals, and the programme is now being implemented by the regions and is scheduled to run for the next 10 to 15 years. In acknowledging that the involved projects were complex and unique to

each region due to demographic factors; and because the regions recognised the need for expert knowledge, the regions sought professional support. The consultancy Ernst & Young was contracted to analyse current infrastructure project practices and propose best-practice recommendations on good project management when implementing large construction projects (Ernst & Young, 2008). In light of several public sector construction scandals where budgets had been exceeded due to poor management accounting practices, the regions were also aware that their practices risked being criticised for being inadequate. As a result, the consultancy KPMG was also contracted to help the regions to develop proper overall management accounting principles and practices (KPMG, 2008a). KPMG devised five main principles, which the regions subsequently committed themselves to following: strategic decision-making and construction supervision at a political management level; development of a management manual, a competent construction organisation, systematic risk management, and independent quality assurance. Overall, the two reports established the guiding framework for the hospital programme's 16 construction projects, although leaving it to the individual regions to determine how these generic principles and recommendations were to be translated into action with the intended effect at the individual hospital construction project level.

Of the two, the KPMG report had the most widespread effects. KPMG had just handed over their report on the construction of the new Danish Radio Building to the Danish parliament (KPMG and Grant Thornton, 2008). This project had turned out scandalous, as it had been delayed by several years and had exceeded its budget by DKK 1.7 billion, corresponding to approx. 57 per cent of the original budget. In collaboration with Grant Thornton, KPMG had been contracted to look into these matters, and their conclusion was that the deviations were due to "poor man-

agement supervision" and "the lack of an effective management control system", particularly "the lack of an effective risk management system" (KPMG & Grant Thornton, 2008, p. 26-32). More specifically, KPMG argued that management had failed to take all material uncertainties into account and had also failed to properly assess the likelihood and impact of those uncertainties that had been taken into account. This meant that the necessary measures to prevent cost overruns had not been taken and that "incomplete risk assessments therefore indirectly had contributed to the increase in the cost of the Danish Radio Building" (KPMG & Grant Thornton, 2008, p. 263).

KPMG and Grant Thornton also showed that Danish Radio had relied on "successive calculation" to conduct risk management, but that the principle had been used incorrectly, which in turn ultimately had contributed to cost overruns.[26] KPMG, however, had thoroughly investigated what went wrong and thus seemed well prepared to advise the Danish regions on how they could apply risk management on the hospital projects. The KPMG report (2008a) here re-introduced the potential

[26] "Successive calculation" is a systematic process employed to identify and assess all material uncertainties related to budgeting of project costs (and other things as well). It works by composing an analysis group that brainstorms on all possible uncertainties that could lead to budget deviations. This group then estimates the financial implications of these uncertainties by creating three scenarios: the most optimistic outcome (best case), the most pessimistic outcome (worst case) and the most likely outcome (most likely case). These calculated financial outcomes are then added to all budget line items in order to arrive at three estimates: the best-case costs, the most likely costs and the worst-case costs of the project. Statistics is then applied to calculate the different probabilities (fractiles) that the final costs will be kept within the budget. Here, the 50 percent fractile corresponds to the probability that the project has a 50 percent chance of being either more or less expensive than budgeted. In relation to the Danish Radio construction project, management had used the 50 percent fractile to calculate budgeted costs. KPMG and Grant Thornton, referring to the work of EMCON, argued that at least the 75 percent fractile should have been chosen, as the project, due to its innovative nature, faced more than a 50 percent probability that cost overruns would occur (with a 75 percent fractile there is "only" a 25 percent probability that the project will incur overruns). As KPMG and Grant Thornton also showed, however, not all material uncertainties had been considered, which meant that the estimation of costs was imprecise to begin with.

benefits of using "successive calculation" to deal with uncertainty, something that the appendix outlined in much detail (KPMG, 2008b). In relation to that, KPMG's recommendations about systematic risk management were further emphasised by the National Audit Office of Denmark (NAOD) two years later (Rigsrevisionen [NAOD], 2010, p. 5). The NAOD, explicitly citing the KPMG report, urged the regions to increase their focus on systematic risk management in each of their projects in order to ensure control of project progress according to set milestones and capital budget. In a later report, the NAOD even reinforced this recommendation by also extending the responsibility for this to the Ministry of Health (Rigsrevisionen, 2011). The following quote illustrates this:

> *"The NAOD notes that construction projects of such scale and complexity involve risks. It is therefore essential that the Ministry of Health specifies and meets its responsibilities as manager of the grants and supervisor to ensure that the construction projects are implemented within the total budget framework. The regions should throughout the construction process be focused on risk management and ensure robust and competent building organisations in order to achieve the objectives set for the construction projects within the budget framework [Danish in original; our translation]". (Rigsrevisionen, 2011, p. 2)*

What prompted the NAOD to conclude this was the disturbing news that the Ministry of Health had consented to the commencement of the construction of the largest of the 16 projects, The New University Hospital Århus, without having ensured that the project could be realised within the funds allocated to the construction of that project. Central Denmark Region had thus reported a significant risk of

having to spend approx. DKK 1.2 billion more than the approx. DKK 6.5 billion allocated to them. The NAOD largely attributed this to inadequate implementation of risk management throughout the five regions, but also to an inadequate approach to risk management by the Ministry of Health. The Ministry of Health had even contributed to the generation of "increased uncertainty regarding project success" (Rigsrevisionen, 2011, p. 3), and the NAOD thus considered the relationship between the ministry and the regions as one of the most substantial risks for project success (Rigsrevisionen, 2011, p. 19). In response to this, The Ministry of Health elaborated on KPMG's 2008 report and introduced the requirement that the regions had to follow the "traffic light assessment matrix", which is an assessment matrix that allows for the grading of the severity of risks into green (low), yellow (medium), and red (high). They also enforced the principle that the regions in future had to assess all risks related to impacts on time, costs and quality and prepare a report on all of these aspects on a quarterly basis (Ministeriet for Sundhed og Forebyggelse, 2012).

Taken together, the concerted efforts by the auditing company, KPMG, the National Audit Office of Denmark and the Danish Ministry of Health resulted in a risk management frame of generic guidelines, which is also consistent with rationalist, generic approaches worldwide (Winch, 2010, Raz & Hillson 2005), such as the Project Management Institute's Body of Knowledge (PMI 2004) and the Committee of Sponsoring Organizations of the Treadway Commission's Enterprise Risk Management - Integrated Framework (COSO 2004).

8.6.3. Overflowing and emerging concerns in the building projects

In the construction projects, much work and effort was being invested in trying to follow the "best-practice" guidelines issued by the NAOD, KPMG and the Minis-

try of Health. In the Region of Southern Denmark, for example, Hospital South Jutland developed a risk manual that was circulated among the actors involved in that project. This manual defined the purpose of risk management, which was "to minimise the probability and impact of those risks that may influence the successful execution of the project" (Sygehus Sønderjylland Aabenraa, 2011a, p. 3). In this context, 'successful execution' meant following the NAOD and KPMG "best practice" guidelines and delivering according to set project goals and objectives, i.e. on time, within project budget and according to set project quality objectives. In terms of further implications, it meant that other measures of success, for example the subsequent operation of the hospital, were defined as being outside the scope of the risk management practice.

The Hospital South Jutland further defined the formal standard risk management process as consisting of identification of risks, assessment of their impact and probability, risk-reducing measures, monitoring and control (Sygehus Sønderjylland Aabenraa, 2011a, p. 8). They also defined that risk meetings had to be held at a minimum at the beginning of every month, or whenever the project entered new phases, and that a risk workshop had to be held right after the establishment of the risk management practice (Sygehus Sønderjylland Aabenraa, 2011a, p. 8). They also described the risk reporting format and reporting frequency: the project organisation had to be briefed every quarter, the steering group on an ongoing basis, and the Regional Council at fixed political milestones. In order to operationalise risk management, the hospital also allocated formal risk management responsibilities; they appointed a risk manager from the project division to supervise the process, allocated risk ownership to various people in the project organisation, who now had to "contribute proactively and reactively to risk management", and appointed a risk steering group consisting of members from the risk owners, the risk

manager and a project consultant (Sygehus Sønderjylland Aabenraa, 2011a, p. 5 - 6). Overall, Hospital South Jutland thus stayed loyal to the recommendations put forward by the NAOD and KPMG and implemented "best-practice" risk management.

During this period, concerns were emerging in the individual project organisations about how to best estimate and manage risks. In relation to the Hospital of South Jutland, new concerns emerged among members in the project team about whether the government could reduce funding (Sygehus Sønderjylland Aabenraa, 2011b). These concerns emerged because the government had reduced the budget by DKK 188 million, which the risk practice had not foreseen and prevented. In an attempt to address this unexpected challenge and problem, the project organisation had listed this event into the risk database as a 'risk' for the project. This, however, gave rise to discussions, as "this risk has occurred; unless there is a new risk that the [construction] budget will be reduced, this risk should be deleted and reported as an occurrence" (Sygehus Sønderjylland Aabenraa, 2011b). As an actual occurrence, "it" should thus not be included as a 'risk' but rather as an 'occurrence'. That it was included as a risk to begin with, however, illustrates that it appears to be challenging to identify what and what not to classify and list as a risk. It reflects that doing risk management is far from straightforward as it required those involved to be taught the highly technical nomenclature of what 'risks' are, i.e., that the term only applies to future and not past occurrences; experiences should thus not be mobilised and included in the risk register.

In relation to the Gødstrup Hospital project, the largest geographical hospital project with a budget of DKK 3.15 billion under the management of Central Denmark Region, concerns emerged about the finer distinctions between 'issues' and 'con-

cerns' (which should not be included) on the one hand, and 'risks' (which should be included) on the other. This distinction became an on-going subject of discussion during the first year of the project, as the project organisation invested considerable resources in manpower, time and training. As the head project manager explained, this was done with the purpose of establishing a proper understanding of risks in order to facilitate the work of the risk management organisation according to the principles of the KPMG report. For further guidance, they had even contacted the Danish Road Directorate, who had earned a reputation for implementing state-of-the-art-risk management in their infrastructure projects, following best-practice bodies of knowledge, such as the Project Management Institute's Body of Knowledge (PMBOK). One core insight obtained through these contacts was the importance of the distinction between the not easily specified concerns and issues and the proper 'risks' about future events of which potential negative future outcomes could be estimated with more certainty. In the Gødstrup Hospital project organisation, however, it had proved extremely difficult to implement this distinction, as project managers tended to list and include 'issues' in the risk database, which they should not:

> *"Risk management is not about concerns [and issues, eds.]. It takes one year of training and education to understand this. I cannot stress how much explanation we had to give to convince people about this. It was not until we explained to them that risks were not about taking responsibility for when things go wrong that we managed to convince them to do this". Head project manager*

The head project manager further explained, which was confirmed by the control manual, that the purpose of risk management was to "execute the project accord-

ing to the approved project proposal and goals without any surprises" (Region Midtjylland, 2011, p. 28). The application for project approval further stated that these objectives were to ensure "compliance with the capital budget", "compliance with the planned time schedule", and the requirement "that quality meets the visions and demands of the hospital projects" (Region Midtjylland, 2012, p. 50). It thus only included those future events that were considered to have an effect on the achievement of *project* objectives, and these only included *cost*, *time* and *quality*. In other words, in the light of the above quote, the very notion of a 'proper risk' to be included came to be part of the unexpected issues and concerns that emerged in relation to the risk management practice.

The discussion about the distinction between issues and risks concerned uncertainties about the classification of entities to be included into or excluded from the risk register. In relation to the allocation of funds to the different projects, the programme applied another distinction which led to concerns and discussions about the justified grounds for these funds. The programme applied the distinction between 'university' and 'non-university' projects, where 'university' projects referred to hospitals that included research facilities and vice versa. This distinction had effects on the amount of allocated funds, because 'non-university' projects were assumed to be less expensive and thus received less funds per square metre. In practice, however, the situation that 'non-university' projects were classified and assumed to be less expensive was not always the case, which in turn generated new uncertainties. The Capital Region of Denmark's New North Zealand Hospital with an approved budget of DKK 3.8 billion, for example, was classified as a 'non-university' hospital and therefore approved at a correspondingly lower budget per square metre than comparable 'university' projects. In this project, early examinations of the construction site had indicated that the ground below surface

was most likely a culturally rich area. It could not be determined with precision, however, what the consequences of discovering such areas would lead to.

While the risk managers anticipated the possibility of a culturally rich ground, further examination showed it to be more complex and rich than initially expected. It did not take much digging before it was revealed that extensive archaeological excavations would have to be commenced. The geological team had found that the ground contained massive chunks of ice dating back thousands of years, and it was estimated that these chunks of ice might contain relics from as far back as the Danish New Stone Age.[27] As excavations commenced, the archaeologists began to locate old dwellings, artefacts and even an approx. 5,500-year old male corpse, presumably murdered. To make things even much more challenging from the perspective of maintaining the construction budget, the chunks of ice rested on large areas of clay, and there were also large holes in the ground, which meant that the ground was highly unstable and would require more work as well as a structural design below ground that was adapted to this complex and unstable ground condition. It would thus require even more detailed geological examinations as well as more construction design work before actual construction could begin. In sum, the unexpected complex geological conditions at the construction site resulted in a revision of the cost estimate, adding DKK 100 million to the initially calculated and formally authorised budget. This new budget and insight also problematised the "university vs. non-university" distinction made by the expert panel and supported by the NAOD and became a strong concern for the project management.

In the New North Zealand Hospital, this problematic distinction between 'university' and 'non-university' project and its subsequent fund allocation scheme was to

[27] In Denmark the New Stone Age, or the Neolithic Era, lasted approx. between 3,900 and 1,800 BC.

affect the actual construction and design work to be undertaken. The project organisation had designed a quite ambitious project with the aim of setting new standards for hospital quality, including a proper kitchen to allow the preparation of food at the hospital. This kitchen was considered to be an important aspect of the planned new and higher standard of health care. However, when the project management realised that the ground conditions at the construction site would incur much higher costs than anticipated, they had to revise their plans. A value management exercise was conducted in order to 'test' the estimated budget against different levels of design ambitions. The project management team carefully worked out the test and even mobilised computer-based three-dimensional building models. The tests and experiments generated new knowledge and insights about the project conditions and also prompted the project management to formulate different design strategies and options. The first and more ambitious strategy dealt with a hospital project that included sufficient funding for a kitchen, but due to the estimated DKK 100-million increased construction costs, this would require extra funds. As the project and construction management explained, "This was a pure extra cost". The second, less ambitious, option was to prioritise and downsize the project in order to meet the current 'non-university' budget. The extra funds were not approved in the ensuing negotiations with the expert panel and ministry, and the project management was forced to abandon the plan to build a kitchen; the hospital ended up being downsized by approx. 12,000 square metres, from 136,000 to 124,000 square metres. As the project management explained:

> *"We must keep the budget, this is very important to us, and also what we are expected to do, so we want the budget to be realistic from the start."*

This statement illustrates that the project management was well aware of the challenges when on the one hand aspiring for high ambitions and innovation in hospital design and health care and on the other hand abiding by controls and risk management principles that emphasised project execution and delivery according to a pre-set budget and project objectives. Similar risk management and downsizing took place in other hospital projects in the programme as well, with emerging concerns and ensuing public debate about the quality and outcome of the projects and the programme. Against this backdrop, a special consultant responsible for risk management across the Region of Southern Denmark's hospital projects considered it to be an extraordinarily difficult and uncertain task to estimate risks on a large and complex hospital construction project with a completion time 10 years in the future:

> *"Frankly speaking, nobody knows for sure if we will be on, below or even twice beyond the budget or more [!]". Risk Manager, Special Consultant*

Another concern, which was even more critical for the projects, according to themselves, was the certainty and rigidity of the formal budget, which seemed to be "made in stone" and treated as such by the expert panel, the ministries and the parliament. In the different projects, this fixed nature of the budget was considered potentially detrimental for the completion of the hospitals, and not least the subsequent operation of them. The special consultant responsible for risk management quoted above explained that "it would have been better to have had more flexibility so that project plans and designs could have been adapted to new and still unknown technological solutions and social and health trends". But, even if long term operational advantages using alternative technological solutions could be

demonstrated using an impeccable investment calculus as support, it would not be possible within the budgetary constraints to negotiate for extra funds. Everything had to be accounted for within existing project budgets, the risk consultant explained, and added that the current risk management set-up appeared to be more concerned with bureaucratic control within the confined space of the individual construction project budget and less with the long-term quality, benefits and value for the operation of the new hospital.

Over time this concern grew, and when the NAOD two years later produced a new report on the hospital projects' management of state funds, they concluded that most projects in most regions had failed to consider whether the new hospital buildings could live up to the purpose of increased operational efficiency and effectiveness (Rigsrevisionen, 2013). In their conclusion, the NAOD wrote that "the regions have often not been able to account for the grounds on which key project decisions have been made", and that now "there is a high *risk* that the regions have made decisions in the early phases that may make it difficult to realise the benefits [of the projects]" (Rigsrevisionen, 2013, p. 2). The regions responded by arguing that the savings would be met in all circumstances, because if projects failed to deliver operational savings, they would have their operational cost framework reduced by the required amount according to project commitment conditions. In response to this, however, the NAOD warned the regions that if they proceeded along this path, they would be demonstrating "an unreflective management accounting practice", which could lead to "uncontrollable consequences" being a "direct violation of the project funding conditions" (Rigsrevisionen, 2013, p. 2).

The NAOD had changed its focus from being primarily concerned with the project economy, the capital budget, and the risk of exceeding it, to now being concerned

with the longer-term 'total economy' of the operation of the future hospitals. The KPMG report from 2008 again became part of the argument. The NAOD reminded the regions that total economy was a vital factor in public construction projects (Rigsrevisionen, 2013). Another reminder concerned the specific requirement for funding, namely that each project had to demonstrate a certain level of increased efficiency and effectiveness in hospital operation compared to a cost baseline defined at the point of project approval. The NAOD thus urged the regions and project owners to *calculate* the productivity gains and 'total economy'. Uncertainty, however, was again recognised:

> *"In connection with the projects, the possibility of using a calculus of total economy is limited due to the fixed budgetary frame for each construction, which may not be exceeded. This means that the regions can only implement solutions that are possible within the allocated frame [Danish in original; our translation]". (Rigsrevisionen, 2013, p. 31)*

The NAOD thus seemed to express concern that the longer-term total economy of the individual hospitals 'in use' might have to pay for the rigidities associated with the 'fixed' construction budget for each of the hospitals at project start. It thus appears that the rigidities of the risk control set-up, which the risk manager of one of the projects had warned against two years earlier, was about to return to the NAOD as an emerging and quite complex issue about risks produced by the current risk management system itself. Although it was still framed in terms of the need for budget control and classic rational risk management for the individual project, the question of uncertainty and lack of flexibility in the long term had re-entered the discussion, which gave rise to new uncertainties about the future value

of the individual projects when the hospital building was put to use. In addition, and relatedly, new concerns and uncertainties emerged about the usefulness and value of emphasising risks at the individual construction project level.

The regions organised risk management in different ways. Some regions centralised risk management of their construction projects at the regional level, while other regions delegated risk management to the individual project level. The focus on the individual project was entirely in line with the NAOD and KPMG's recommendations – all regions had to report on project risks at the level of the individual construction project. Yet, project managers and risk managers also expressed concerns about the focus on the individual project. Some also questioned the related focus on the 'total economy' of the individual hospital when the building was put to use. A systemic understanding of public healthcare seems to underlie their concern: The hospitals in a region were mutually interdependent and had established a division of labour concerning patient treatments and capacity. Downsizing one hospital due to budget concerns related to an individual hospital project could generate complex and less desirable performance effects on a systemic level, not only in terms of the total economy across hospitals in a region, but also in terms of the region's capacity and quality of treatment in a longer-term perspective. One risk manager referred approvingly to the regions that had managed to counterbalance this strong focus on the individual project risks by organising risk management at the regional level. In effect, such a risk management organisation would facilitate a more systemic understanding of risks across the individual construction projects in the region's project portfolio, rather than just subscribe to a narrow focus on the individual hospital.

To sum up, the hospital construction programme and projects show the complex dynamics of risk management, for example how new issues and uncertainties emerge due to the way risk management has been set up and performs. An integral part of this dynamics is the difficulty of the existing risk management framework to take into account actors' knowledge and concerns that goes beyond the formal definitional notion of 'risk' as it is enforced through the distinction between 'issues' (or out of project scope) and 'risk' (within the project scope). The distinction generates new uncertainties concerning what to classify as a proper risk. Related discussions concern classifications of the projects themselves, is it a relatively simple "non-university" project – or rather unexpectedly, a geologically complex and culturally rich project? Relations and concerns about the hospital in use, such as the design and quality of having a kitchen in the hospital becomes secondary to the emphasis on managing the *project* risks to ensure consistency between *initially* stipulated project goals and outcomes – and in particular those related to the cost, time and budget frame of the construction project. Quality, by contrast, appears to be a more complex and fragile phenomenon, being more difficult to measure and monitor during the project risk management processes. Quality and associated design ambitions also appears to be increasingly more uncertain as the short term risk management concern about keeping the construction budget becomes more important than the longer term value, the total economy as the NAOD wrote, of the future hospital in operation.

8.7. Risk management in practice: the Signalling Programme

8.7.1. Background

In January 2009, the Signalling Programme came into being as the Danish parliament decided to fund a DKK 23.7 billion programme of renewing and replacing

all Danish railway signalling before 2020/21 (Transportministeriet, 2009a). The Signalling Programme here refers to the total programme of renewing all Danish railway signalling from basic train detection and point machines to overall traffic management systems. It came into being because the signalling systems had aged to the point where an asset-by-asset renewal would exceed total renewal costs in 2024, which meant that it would be more expensive to do nothing. At the same time, about 39,000 trains per year were delayed, accounting for about half of all nation-wide train delays, because of the state of the existing signalling systems. In the years from 2000 to 2005, this prompted the National Audit Office of Denmark to look into Rail Net Denmark, the state-owned enterprise that owns and manages the railway infrastructure, which resulted in the organisation being criticised for having "inadequate practices of management accounting" (Rigsrevisionen [National Audit Office of Denmark], 2002, 2004, 2005). Over the years, this had led to misinformation of the parliament as to the current state of the railways, the maintenance backlog, increased passenger traveling time and reduced train punctuality. The Signalling Programme was launched in order "to ensure a robust and sustainable long-term agreement and a total prioritisation regarding the future development of the rail network" (Finansministeriet, 2006).

The Signalling Programme represents more than just a restoration of train regularity as a straightforward economic business case; it also represents the first Danish attempt at introducing an all-encompassing practice of risk management. In 2006, the Danish Ministry of Finance had grown tired of repeatedly having to deal with cost overruns on large infrastructure projects (Finansministeriet, 2010). In an attempt to avoid this, the Ministry of Finance, in close collaboration with the Danish Ministry of Transport, had been inspired by developments from Norway and the UK, where "reference class forecasting" had been implemented (Transportminis-

teriet, 2006). This concept replaced the existing practice of including risk estimates when calculating cost estimates by a different practice of calculating cost estimates using historical prices and quantities. The Ministry of Finance then emphasised implementing an all-encompassing risk management practice in order to ensure that cost estimates could still be met. In acknowledging that large infrastructure projects were unique in nature and consequently faced great uncertainty regarding achieving its costs, the Ministry of Finance and the Ministry of Transport also introduced a risk margin of 30 per cent that was to be added on top of the budget. This margin was not to be used unless under observation of strict rules, so much trust was put into the risk management practice in order to ensure that cost overruns would not happen and thus that project objectives would be met.

The Signalling Programme runs from 2009 until 2020/21 and has been divided into three main subprojects; the regional lines west, the regional line east, and the Copenhagen mass transit system. It also consists of several minor subprojects that are important for achieving the objectives of the three main subprojects. The programme employs on average more than 120 people, of whom approx. two-third are externally hired consultants, which makes this project the most consultant-dependent project in Denmark to date. As the Ministry of Finance and the Ministry of Transport were uncertain about know how to approach risk management, the actual risk management practice was designed by consultants. It uses the approach to risk management defined by the Project Management Institute's Body of Knowledge (PMI, 2004), known as PMBOK, which represents one of the current "best-practice" approaches to project management worldwide, and it includes a large section on systematic risk management.

8.7.2. The development of the risk management frame

> *"When we decided how we wanted to construct the practice, we agreed that we would follow PMBOK to define our risk terminologies. We just didn't want people to question our understanding of risk management… There are so many ways [to construct a practice] and it is hard to tell what is right or wrong. But if we can agree that we use this approach, "that's it". It's just more simple like that". Senior Risk Consultant (I2, 66, 73)*

PMBOK was not the obvious choice of framework; but "we just didn't want people to question our understanding of risk management", as the consultant said. PMBOK was chosen, however, and the practice was framed around that. This framing meant defining risks as "potential events with either positive or negative impact on project objectives" and risk management as "the systematic processes of managing risks". The latter meant introducing the well-known iterative process of: "risk identification, risk assessment, risk reduction and monitoring and control" (see also last section) and integrating this with project processes throughout the lifespan of the project and the subprojects. It also meant drawing upon a cause-and-effect based logic when describing risks, where actors have to define risks and link them to project objectives, as well as applying the "traffic light assessment matrix", where risks are assessed using the probability times consequence logic and subsequently assigned the colour of red (high), yellow (moderate) or green (low) to prioritize their severity, and basing risk reducing actions on that prior assessment. In selecting the categories on which to base the assessment of risks, the risk consultants decided that risks were to be assessed related to their impact on

cost, time and punctuality (quality), which also reflected PMBOK. In relation to the above, the consultants further specified the purpose of the practice:

> *"The objective of the risk management process is to bring all project risks to acceptable levels in accordance with the risk rating matrix. This means that risks rated as High [red] and Moderate [yellow] must be mitigated unless it is possible to demonstrate that the cost involved in reducing the risk further would be grossly disproportionate to the benefit gained". (Ramboll, 2009)*

In further framing the practice, the consultants also defined the different types of meetings that were necessary (risk workshops, risk follow-up meetings and cross-risk review meetings), those to be involved (project managers, programme management and other stakeholders) as well as the reporting structure of the practice. The consultants distributed the responsibility of identifying, assessing and reducing risks to project managers, who were assigned the role of risk owners, while they retained the role as the experts managing the practice themselves. In order to keep track of the status of the identified risks and risk reducing measures and to generate overviews of the current risk status, the consultants then designed an IT-based risk management control system. This IT-based system enabled the consultants to better operate the practice, by for example keeping track of responsibilities and actions, presenting plans for risk reduction, providing documentation for what had been accepted, and by whom, and not least by visualising risk developed over time with the construct of 'value at risk', which demonstrated how large a percentage of the budget is at stake at any given time. It uses Monte Carlo simulations to arrive at that total cost estimate, but relies on risk owners to actually provide the individual risk cost assessment that it uses to calculate total costs.

In the years between 2006 and 2009, the above framing and implementation of risk management was carried out, and during that time, in 2008, the Ministry of Transport was able to produce and proudly present a guidance document for all entities under its jurisdiction in charge of large infrastructure projects on how to do risk management (Transportministeriet, 2008). This document made explicit reference to the Signalling Programme and emphasised how this represented a best-of-class example of how to carry out risk management. In 2009, when the programme organisation was coming together and the programme entered the procurement phase, most people involved, the consultants, the Ministry and management alike, felt very confident about the capabilities of the practice. The National Audit Office of Denmark had also ceased been critical towards Rail Net Denmark and its lack of a proper management accounting practice (Rigsrevisionen, 2009), and by 2008-09, the Danish Road Directorate could similarly introduce risk management, heavily inspired by the Signalling Programme (Transportministeriet, 2009b). In summary, the framing of the practice of risk management in the Signalling Programme had thus been so successful that other practices were now also being framed along similar lines (See the previous section on Gødstrup Hospital).

The following years as the programme left the programme definition phase and entered the procurement phase, which ended with the contracts for the three main subprojects being signed; the consultants operated the practice successfully. The project managers had been successfully involved in the practice and provided input to the control system according to the way the practice had been framed. It also helped that the consultants were able to show decreasing 'values-at-risk' and demonstrate changing risks at each status report deadline. This indicated to the programme management and the Ministry of Transport that the project was well

on track; and these actors, in turn, were very satisfied with the risk management and the progress of the project.

8.7.3. Overflowing and emerging concerns on the Signalling Programme

As the project moved further away from the initial project planning and specification phases, concerns began to emerge. In the beginning, these concerns were mostly related to minor issues, such as some project managers finding the risk meetings a time-consuming exercise, or others finding the processes or the IT-system confusing. Some of the project managers were sometimes reluctant to accept this new way of doing risk management. There were also concerns coming from the programme management and the consultants who had constructed the practice. The two quotes below illustrate a risk manager and a risk supervisor, respectively, articulating such emerging concerns regarding the overall practice:

> *"It is not all our project managers who work with risk management in the same way just because they are project managers on infrastructure projects where you have to make this work. We are forced to constantly negotiate with some of them if we want them to accept their role, not least the risks themselves, the way we want them to do so…". Risk Manager (I1, 279)*

> *"You have to recognise that doing risk assessments is uncertain, but that does not mean you should stop doing them… Employing the 5x5 matrix **does** limit that uncertainty... It's not an exact science; forget it... but with risk management you **can** calculate the level of uncertainty fairly accurately". Senior Risk Consultant (I2, 171)*

In the early years, the consultants overcame these issues by organising regular meetings every second month, as well as risk workshops on a regular basis. These meetings and workshops allowed the consultants to enforce the framing through dialogue and rational argumentation with the project managers. However, as the project progressed further into contract negotiation, and later after the contracts had been signed, events started to take place which made project managers question the reliability of the practice. These project managers would argue that the certainty generated by the practice had more to do with pleasing the governing bodies and less to do with reducing actual risks. One such event was the bankruptcy of Pihl and Son, a major Danish contractor, who had been contracted to construct two new traffic control centres. This event sent ripples throughout the construction sector, as many small contractors whose businesses depended on Pihl and Son went down with them. It also meant that construction on the two traffic control centres came to a halt. It turned out not to have severe consequences after all, as construction of the two control centres was not a part of the critical path that needed to be followed for the entire project to be completed. The Signalling Programme went back to the initial bidders for the contract and chose the second best bid, which meant that actual costs "only" increased by a few million, but the event did make project managers question whether having a formal practice of risk management could prevent such events.

Another issue concerned the situation that several project managers realised that proposed risks could not be accepted if they could not be made measureable in terms of the cause-and-effect description logic mentioned above. This led to concerns on multiple occasions, as project managers often had 'gut feelings' from prior experience that could not be included, as the project managers were unable to

translate such feelings into "proper" risks. However, it was not the more experienced project managers who expressed this concern; they were often able without any problems to make their felt uncertainties measureable. It was the new and comparatively inexperienced project managers with only a few years of project experience but still enough, according to themselves, to have 'gut feelings' about risks, who felt their concerns were neglected by the practice. In one case, for example, a project manager was very sceptical of a newly signed contract with a supplier because he knew from prior experience that this supplier tended to make mistakes that could lead to delays. When he explained this to the consultant operating the practice, his perceived risk was excluded on the grounds that it could not be accounted for within the boundaries of the practice. Two years later, that same supplier made mistakes in both design and testing that caused several trains to be grounded by the traffic authorities. This situation almost turned into a major media scandal, as timetables came as close as possible to having to be completely changed (which would have resulted in longer traveling times, fewer trains, etc.). Fortunately for the project that did not happen.

It was this type of situation, however, that made project managers express their concern about the capabilities of the practice, and its relevance, as it took hours of work. In that connection, the project managers would repeat that the project was scheduled to run for approx. 12 years, and because of its uniqueness, it could be prone to many such events. The lack of ability to accommodate such gut feelings, concerns, hunches, and intuitions of actors with years of experience was therefore seen as risky in itself. The following quotation problematises this:

> *"The risk assessment, I am convinced, encounters the fundamental problem that it needs to be conducted within the framework of the*

human psyche that allows us to plan maximum one year ahead. All things assessed after this becomes something we cannot, but still need to, work with. In the risk meetings we all reach this conclusion. This troubles us". Risk Manager (I1, 159)

As the quote demonstrates, the central actors of the practice were aware of the problem, but over the course of the project it remained unsolved. This relates to one more concern held by the project managers, namely that once the initial project description had been made, the budget had been locked, and the overall focus seemed to be on preventing cost overruns. This was evident to many, as the assessment categories when assessing risks focused primarily on cost and time (as these were the two factors reported on) and not so much on punctuality, despite the situation that this had been included into the practice as a factor to be assessed. In practice, this meant for the project managers that the practice could only take those risks into account that they were able to qualify in terms of effects on, first, project objectives, and second, time, cost and punctuality. This gave rise concern on the part of project managers who wanted to take effects into account on *later* operations, such as increased maintenance costs or reduced operational quality. They also wanted to assess the effects of risks on the objectives of other entities, such as the small private train operators and/or on their own subprojects. These needs of the project managers, however, were dismissed by both consultants and the programme management as being "out of scope" and "merely concerns". These proposed risks by local project managers were thus excluded as risks to the risk management practice.

To illustrate this concern, a safety manager and a head project manager of a subproject discussed raising the cost impact assessment of a certain risk (classified),

because new events had taken place which had caused them to face new uncertainties, the safety manager argued. The head project manager found such a high assessment unrealistic. The two participants continued to discuss this, but the situation appeared deadlocked, as none of them was willing to give in to the other party. At that time, the safety manager had not mentioned that the impact he envisioned would be on subsequent operations. As during the debate, the head manager suddenly became aware that the reason for the proposed higher assessment related to such subsequent operations, the deadlock was broken. Now he could explain to the safety manager that because the practice focused on the objectives of the project and not on later operations, the higher assessment was irrelevant to the programme. The safety manager looked surprised, but as the head subproject manager's words were supported by a risk consultant, who explained to him that such were the rules of the practice, the discussion ended. In short, this situation illustrates that when risks have effects on anything else but the capital budget (or the chances to meet it), such as later operations, they are excluded from the practice.

Similarly, the project managers had to accept that events that were known to happen, or had happened, but the effects of which were unknown, were also excluded because they were outside the boundaries of the practice. This was evident as the practice is based on a best-practice framework of risk management in which such events are not considered to be risks at all; they are termed ‘issues’, or in this case, ‘day-to-day operations risks’. The consultants further argued that because such events happened all the time, it would be too ambitious and too comprehensive to take them into account. The project managers argued that these so-called ‘issues’ represented the large majority of all risks and thus represented the majority of what they spent their time dealing with. Excluding them thus led to the alienation

of risk management from everyday work. The risk consultants listened to the project managers' arguments, but they still insisted that project managers dealt with them outside the formal practice of risk management. In effect, this made many project managers conduct their own simultaneous risk management practices bringing those "issues" into account, which, in turn, led to new uncertainty for the risk consultants regarding the completeness of the more formal practice.

In summary, the Signalling Programme represents a case where risk management has been framed around a best-practice risk management framework with all that entails: from framing risks as "uncertain events with positive or negative impacts" to assuming the logic that risks can be reduced by defining a risk appetite, identifying risks according to the logic of cause-and-effect, making assessments on time, cost and quality (punctuality), taking action based on such assessments, and monitoring and controlling the practice by producing risk values that indicate whether more or less action needs to be taken. It also entailed distributing responsibilities to project managers as owners and risk consultants as expert knowledge producers framing when and how to have risk meetings and setting the agenda for such meetings. In this respects concerns emerged from especially project managers who were worried about the relevance of risk management, its ability to provide certainty, and the work it required. This was emphasised, either when events occurred that the practice had taken into account but which occurred nevertheless, or when events occurred that the project managers had raised as an issue but which could not be included because of the way risk management had been framed. The following section examines the similarities and differences between these practices and looks into the role of knowledge in risk management practices.

8.8. Developing the overarching frame – RM practices and overflowing across the two programmes

With respect to the Signalling Programme, recent legislation had made it compulsory to implement risk management, and with respect to the Hospital Programme, the Danish Radio Building construction scandal had led KPMG and Grant Thornton to strongly recommend more systematic risk management. Rail Net Denmark, the organisation responsible for carrying out the Signalling Programme, recognised that they did not have sufficient competencies to manage the project and thus contracted with a consultancy conglomerate, of which one member, Ramboll, developed guidelines on how to practice risk management. This was similar to the Hospital Programme where two consultancy companies, Ernst and Young and KPMG, were contracted to develop both overall project management guidelines and more specific management accounting principles, one of which concerned systematic risk management. In the Signalling Programme, however, Ramboll were also made responsible for operating the practice, which was different from the Hospital Programme, where the individual projects became responsible for operationalising the guidelines produced for them by KPMG.

One of the major reasons for the decision to use consultancy firms in the two programmes was because the Ministry of Finance, and subsequently the two relevant responsible ministries, had developed a particular *control ambition* in close collaboration with consultancy companies in order to strengthen management control and prevent cost overruns through systematic risk management in large projects. This particular control ambition also appeared from government white papers on infrastructure projects which were circulated to the different ministries, directorates and departments at the time when the decision had to be made whether to approve the projects for construction (See for example, Transportministeriet,

2006, 2008; and Finansministeriet, 2010). This control ambition was further supported by the National Audit Office of Denmark, which on several occasions had criticised the lack of adequate management control systems in Danish public institutions (e.g. Rigsrevisionen, 2004, 2005, 2011, 2013). At the same time, however, the Ministry of Finance lacked experience in implementing such procedures and left the two programmes with the challenge of figuring out how to do that on their own. In doing so, the programmes took on expert assistance by contracting consultancy companies (albeit different ones)

Despite the fact that these were different consultancy companies, they ended up recommending systematic risk management based on *the same conventional rational risk management approach*, the current best-practice approach seen across many organisations and sectors. In the Signalling Programme, Ramboll explained that they wanted to use a solution that people were already familiar with, so they drew upon the generic "best practice" Project Management Institute's Body of Knowledge' section on risk management. This entailed defining risks as "potential events with either positive or negative impact on project objectives" and risk management as "the systematic processes of managing risks". The project objectives were defined as being completion on time and within costs and the achievement of increased punctuality (quality). Risk management meant defining a pre-given risk willingness and then identifying and assessing risks according to their impact on the project objectives, reducing these risks below the level of the willingness, and monitoring and controlling the entire process in order to provide feedback adjustments as necessary. It further meant integrating risk management with other project processes throughout the lifespan of the project and its subprojects. It was also recognised that no statistical data could be used to make the assessments, which meant that the practice relied on the 'best' judgment of the parties involved.

In the Hospital Programme, KPMG similarly drew on the conventional generic "best practice" approach to risk management, although being less focused on a "one size fits all" principle, as the purpose was to let the regions decide for themselves how they wanted to implement the practice. In their report, KPMG defined risks as being "potential events with either positive or negative impact on project objectives", and risk management as "the continual assessment of project risks with the purpose of creating an overview of these so that the necessary actions can be taken according to pre-given risk willingness". KPMG also stated that the level of risk willingness should be defined in relation to the project objectives of time, cost and quality, and that risk management should be conducted throughout the lifetime of the programme. The two programmes therefore came to bear many direct resemblances to each other: the reliance on the generic "best practice" expert-knowledge of consultants, the identification of risks related to project and project-only effects, the assumption that uncertainties can be measured, categorised, plotted, ranked and visualised into matrices, the definition of pre-given risk willingness at the beginning of the project, and the rational planning and action-taking according to this throughout the lifetime of the project. Thus due to these similarities, the two programmes also came to be situated within an overarching risk management frame.

When it came to the operationalisation of these overarching principles, however, the two programmes went in different directions. In the Signalling Programme, Ramboll defined the different types of meetings that were necessary (risk follow-up meetings, risk workshops and cross-risk review meetings) and the frequency of them. They also defined which actors were to be involved (project managers, programme management, suppliers, etc.) and distributed their responsibilities (e.g.

project managers as risk owners and themselves as risk experts) and decided who were invited to meetings. They further set up the risk organisation, defined the reporting structure and produced the status reports, and they developed the training material and IT-based risk management system. In addition, the system allowed them to facilitate practices such as recording risks, keeping track of responsibilities and risk reducing actions, documenting what was accepted and by whom, and not least categorising, prioritising, ranking and visualising risks according to the "traffic light assessment matrix". The system allowed the practice to follow up on the risk willingness, which was defined from the outset as follows: risks graded as high (red) and moderate (yellow) should be reduced unless it was unfeasible to do so, while risks graded as low (green) could be accepted (unless they could be reduced without incurring extra costs).

The Hospital Programme approached the operationalisation of the guidelines differently, as the regions could decide for themselves which actual tools and principles to work with. In this respect, KPMG recommended "successive calculation" among other tools, something which the different regions decided to follow when they did their initial risk assessment. In integrating this across the individual regional projects, they also defined which actors to include (project managers, programme management, etc.) and allocated specific roles to them in order to make sure that the project objectives would be met. As the programme organisation differed from one region to the next, these responsibilities were distributed differently, but the logic of having risk owners and risk experts/facilitators remained the same. In the beginning, they also had different reporting standards, but after the National Audit Office of Denmark had criticised the Ministry of Health for having neglected their oversight responsibilities, they also introduced the "traffic light assessment matrix". The different regions defined different levels of risk willing-

ness, but the same logic about reducing high (red) and moderate (yellow) risks while to a certain degree accepting low (green) risks remained the same. It was much more individual from one region to the next how actual meetings, identification criteria, etc. were organised. Some had monthly meetings while other had meetings at more irregular intervals.

In contrast to what was the case of the Signalling Programme, KPMG's recommendation on the use of "successive calculation" and the regions' subsequent adoption of them was unexpected. In 2006, the Ministry of Finance in collaboration with the Danish Ministry of Transport had banned the use of "successive calculation" in large infrastructure projects carried out under the auspices of the Ministry of Transport due to bad experiences with this principle across *all* types of construction projects. The use of "successive calculation" had led to massive cost overruns. In the Hospital Programme, however, this principle was promoted by KPMG in their reports as a solid tool to practice systematic risk management, and KPMG's reports, in turn, were promoted by both the NAOD and the Ministry of Health. Considering the actual elements of "successive calculation" in the individual projects, however, this amounted to much the same basic conception. In these projects, risks were also defined as "events with impacts on project objectives", although sometimes the focus was only on negative events, and sometimes only "surprising events". In its basic logic, however, focus was still on *the* project and the same objectives of time, cost and quality.

When we looked into the details of the practices, however, it was evident that at least one of them had been set up along the same lines as the Signalling Programme. At Gødstrup Hospital, like many of the others, the project organisation had been unsure about how to develop their practices, which was why they con-

tacted the Danish Road Directorate. As the analysis showed, a few years earlier the Road Directorate had adopted the Signalling Programme's risk management approach, as the Ministry of Transport, supervising both organisations, promoted the Signalling Programme's risk management approach as best-practice and introduced it across the entire Road Directorate organisation. So, in unexpected ways the Signalling Programme's practice found its way to the Gødstrup Hospital project, and the two projects thus used the exact same tools and concepts. This shows that although risk management might be introduced as generic principles and guidelines by ministries and expert consultants, it needs to be executed locally in project practices, which in turn can generate local variances, or lead to very similar forms.

The National Audit Office of Denmark was involved in both cases, although more actively in the Hospital Programme. In the years leading up to the parliamentary approval of the Signalling Programme, however, the NAOD was very active in criticising Rail Net Denmark, the organisation in charge of the Signalling Programme, for having "inadequate management accounting practices". In response to this criticism, and with the implementation of the "New Budgeting Method", Rail Net Denmark introduced an all-embracing practice of risk management. This, together with other initiatives, silenced the NAOD, and a few years later they concluded their examination of Rail Net Denmark, and today they still have not specifically published any reports on the progress of the Signalling Programme. In contrast, two major reports were produced on the Hospital Programme. The conclusion was that the regions exhibited "inadequate practices of risk management". The NAOD acknowledged the work of KPMG and their focus on systematic risk management and thus recommended to the regions as well as the Ministry of Health that risk management should be implemented holistically.

The Signalling Programme and the Hospital Programme may have ended up framing the practices according to the same basic conception, but this did not only enable risk management; it also led to overflows due to the strong focus on project objectives. In both cases, those risks that could be defined as "events with effects on project objectives" could be included, but those related to, for example, "issues" were excluded for being "out of scope". This led to emerging concerns from groups of actors, especially project managers, who felt that this was difficult to understand. In the Signalling Programme, this occasionally meant that events were not taken into account, but still had "effects on project objectives", such as when the project manager suggested that they could have collaboration issues with one of the new suppliers, which was rejected, but which did result in collaboration issues, for example when the supplier made a design error which resulted in the grounding of several trains. Across the cases we found that possible and uncertain effects on the future operation tended to be excluded as 'issues' or considered 'out of scope' in relation to the defined project goals. The cases demonstrated that using conventional risk management led to a strong focus on risks related to the capital budget, either through increased direct costs or time delays that had indirect cost effects.

The cases also further demonstrated that the *NAOD actively promoted* risk management across the cases. In 2013, however, the NAOD shifted their focus from having promoted risk management to pointing to a potential problem related to the fact that risk management had been applied only on *project* objectives. This meant that focus had been very much on the capital budget and less on what they termed the 'total economy', which therefore included later operational costs. This was one of the objectives of the Hospital Programme (also the Signalling Programme),

meaning that because of the strong focus on risk management and uncertainty reduction, aimed at the capital budget, the regions *as well as* NAOD, KPMG and the Ministry of Health had suddenly and together created the unexpected effect of producing new uncertainty regarding the achievement of another one of their objectives, that of the 'total economy', or a reduction in subsequent operational costs. In the Signalling Programme, this was also evident, but here the NAOD was absent. In the Signalling Programme it was clear from our observations that risks having effects or implications for later operations, maintenance or quality were excluded: the focus was on costs, time and punctuality, those aspects that had been identified at the beginning of the project. The two cases thus both demonstrate how a particular framing of what constitutes risks can lead to overflows and re-problematisation of project conditions and thus create new uncertainty.

8.9. Concluding discussion

In this paper we have raised the question of how risk management practices shape project conditions for large construction and infrastructure projects and with what ramifications for knowledge and as project management roles. In addressing this question we have drawn upon actor-network theory and Callon's (1998a) conception of framing and overflowing.

Three conclusions come to the fore. The first involves what gets lost, or what overflows, through the framing and enforcement of rational risk management processes. From the inability to include the 'hunches' of experienced engineers in the signalling case, to the threat of losing sight of the longer-term value of the hospital projects as the rigidities of budget and risk control close off more ambitious future-oriented thinking, relevance is lost and a hot situation emerges. For the project organisations, the rational risk management approach creates a serious dilem-

ma and challenge. On the one hand, nobody knows what the project results will be ten or twenty years into the future. On the other hand, the rational risk management approach presupposes that knowledge from the start of the projects and programmes. The risk consultancy companies, ministries and the NAOD go along with that superhuman knowledge assumption when giving primacy to consistency and integrity between project plans and outcomes, as if fundamental project uncertainties can be reduced to identifiable (known) risks without any loss. The second conclusion concerns the problem of a focus on identifying the responsibilities for specific risks, promoting a short-sighted and self-interested approach to management, as seen with the dismissal of operational risks as unimportant for the delivery of the capital programme in the signalling case. Both of these conclusions thus suggest the partiality of existing risk management practices, and the narrowness of their particular framings, the overflows from which represent in themselves potential longer-term threats to the societal and economic value of the projects.

Our third conclusion is that both cases involve the application of calculative practices to very uncertain contexts. We are not necessarily dismissing the utility of existing risk management practices, but it does need to be recognised that this is a practice of trying to rationally calculate under uncertain knowledge conditions, and that there might be other more inclusive ways of thinking about risk and uncertainty. For example, we have drawn attention to different risk policies in the Danish state and ministries, perhaps most notably how the state both promote and abandon 'successive calculation' across the two programmes, but also how the NAOD plays a more or less active role in promoting such risk management practices. Risk management in this case clearly transgresses the individual project and its management. It is a much more distributed collective form of cognition and calculation, which in effect implicates the NAOD, the Danish state and ministries

as well as the many consultancy firms. When these organisational actors promote certain risk management frames, with corresponding assumptions about knowledge, predictability and control, it might come at the expense of innovation, novelty and intelligent outcomes. Thus actors and agencies such as the NAOD might also put the programmes and projects at risk – the project risks are not independent of the ways in which those risks are framed, but are integral to the frame and its maintenance.

A related and practical question is how a risk management frame based on a 'technology of rational choice' can be reframed and thus enriched with what March (1971) termed a 'technology of foolishness'. We ask this question, since the latter seems to be in short supply and also because it seems to resonate with the emerging concerns and dilemmas that the project members encounter when working under those conditions, feeling that they have to carry all the burden and the responsibilities for the outcomes, as if they were solely responsible for the project conditions as well. They are not alone in this, and cognitions and responsibilities should be distributed accordingly so that the consultancy firms, ministries and public authorities that are active in making and maintaining the frame can be included in it. One advantage of this extension and reframing is that the risk management devices put in place by the agencies to frame and condition project processes and outcomes become more visible. A second advantage is that it acknowledges the fact that actors and agencies are reflexive, and that knowledge produced during the project processes can become a highly valuable resource, provided that the risk management devices can be reframed to take it into account. Our study shows this reflexivity and potential, but it also shows that the current rational risk management frame has difficulties in taking actors' emerging concerns and thus their knowledge and reflexivity into account. This poses a particular chal-

lenge and dilemma for project management roles and responsibilities: On the one hand the formal, prescribed role and responsibility to adhere to rational risk management, and on the other recognising the limitations of that frame and developing risk management practices that can better acknowledge the value of new innovative ideas, knowledge and insights produced in the project process. Our work and findings side with the latter task and challenge of re-framing the conventional rational risk management.

We began this paper with Callon's reminder of what uncertainty is – something we do and cannot know. Embracing and responding to this in ways which complement more instrumental notions of risk management may have significant implications for risk management practice, but it may also produce significant benefits for the delivery and overall value of large infrastructure projects.

9. Discussion and conclusion

> *"It is a world of change in which we live, and a world of uncertainty. We live only by knowing something about the future; while the problems of life, or of conduct at least, arise from the fact that we know so little".*
>
> *– Frank Knight (1921, III.VII.4)*

This section begins by summarising the key findings from the three analytical sections that correspond to the three research papers. I have attempted not to summarise the findings too much, as the whole purpose of case studies is to enable the capture of details rather than to provide a summarised account. I therefore refer to the three papers for more elaborate details of the findings made in this dissertation. The second subsection describes how this dissertation contributes to the academic literature, by linking the main findings from the three papers and the overall research question put forward in the beginning of the dissertation. The third subsection follows up on this by elaborating on the implications of the contribution for the practising of risk management. The fourth section describes the limitations of this dissertation; and the fifth and last subsection sets out directions for future academic research.

9.1. Summary of the main findings

The first paper examined the processes of translating uncertainties and risks, but rather than defining these two concepts as either unmeasurable or measurable entities "out there", the paper drew upon the anti-essentialist stand taken in actor-network theory. This meant that the paper defined uncertainties as the things "we know we do not know" and risks as the more limited amount of uncertainties con-

structed as such (Callon et al., 2009). In order to provide empirical detailed descriptions of this, one of the largest Danish public capital investment programmes, the DKK 23.7-billion Signalling Programme, was followed. In relation to this programme, examining the processes of translating uncertainties into risks meant examining how uncertainties were translated into "uncertain events with either positive or negative impacts on project objectives", because that was how the programme management and the consultants contracted to manage the practice defined 'risks'. Their approach was inspired by the Project Management Institute's Body of Knowledge (or PMBOK), which was (and still is) considered one of the best-practice frameworks for organising practices of risk management. In accordance with this framework, 'risks' were defined as being describable through cause-and-effect relations and calculable through the logic of probability times consequence.

Contrary to the expectation that uncertainties would either be made calculable, and thus included as risks, or not, and thus excluded as risks, the first paper found that we had *to distinguish between two types of constructed risks: pure and impure risks*. The paper showed that some uncertainties were indeed translated into "uncertain events with either positive or negative impacts on project objectives", but because the people who suggested them, typically project managers, could not describe or assess them according to the criteria of the formally established practice, they were deemed "mere" uncertain things and excluded as "risks". The paper went on to show that for the actors proposing them, these uncertainties tended to be *re*-constructed as risks, but this time in localised and subproject-specific practices. In practice, however, because these risks had been excluded from the formal practice and thus lacked management attention and resources, local managers found them problematic to deal with: Some risks were reduced and some were lat-

er re-described to fit the criteria of the formal practice, but most ended up as 'yellow post-its' on a whiteboard, increasing in number over time and creating new uncertainties for the practice as well as the entire programme.

The paper also examined the reasons for this construction of pure and impure risks, and found that *it was primarily the implemented IT-based risk management control system (the risk database) that created this distinction*. This IT-based control system ended up purifying the processes of constructing and managing risks because it was present at all risk meetings and only allowed the inclusion of those risks that could be described in accordance with pre-established criteria (the pure risks). In these meetings, a visualisation of the system would be projected on the back wall of the conference room, and all the attendees would be watching it during their description of risks. This IT-system would show the cause-and-effect risk description fields and the assessment category boxes that had to be filled in in order for the risk to be recorded and included as such. If the participants were unable to provide this information, the proposed or described uncertainties would remain just that and never be included as risks. They would be excluded in spite of the finding that to the participants proposing them, they still represented "uncertain events with either positive or negative impacts on project objectives". In relation to this finding, the paper also made findings regarding the types of risks included and excluded, the importance of understanding risk management within the larger budgetary frame, and the importance of understanding the work done by the risk experts: the risk consultants.

In complementing the first paper's focus on the translation of uncertainties into risks, the second paper focused on the relationship between the framework drawn upon to construct the practice, PMBOK, and the later practising of risk manage-

ment. This paper continued the reliance on the Signalling Programme, but extended the period under examination to also include the period from 2012 to 2014 (the first paper focused on the period 2010 to 2012). As the paper focused more broadly on the entire practice of risk management rather than the more specific processes of constructing risks, the paper also expanded the actor-network studied. This led to the inclusion of the main suppliers and the main train operator as "new" actors, and also to the inclusion of programme management and the governing state bodies to an even larger extent. As a result, the amount of observation studies, the number of interviews and the documents collected were almost doubled. The second paper also focused on a situation where the practice of risk management was producing *un*certainty rather than certainty and sought to explain the conditions under which the practice succeeded in overcoming this situation.

The second paper arrived at three key findings. The paper showed firstly that the risk consultants and the programme management could *produce certainty regarding project objectives, not only by reducing actual risks, but by framing and reframing the way risk management was practised*.[28] In this sense, the paper showed how the consultants framed the practice of risk management in ways that enabled the production of increased certainty, which was to be demonstrated by the 'value at risk' curve. It then described how events took place that caused the practice to misfire, meaning that events caused the practice to produce increasing 'value at risk' curves (symbolising increased *un*certainty), despite the fact that the practice was adhering to all the precepts of the PMBOK-framework. The paper then followed how the consultants managed to turn the developments around in order to

[28] It should also be pointed out that I am not saying that no risk reduction took place or that no risk reduction will ever be necessary. I am saying that I observed that despite the fact that risks *were* reduced, the 'value at risk' curve was *still* increasing, which indicated flaws in the logic of the implemented framework (as this curve was to produce decreasing 'value at risk' and thus generate increased certainty – and not the other way around).

be able again to produce a decreasing 'value at risk' curve without solely relying on the reduction of risks. I need to stress that I did not observe any attempts by the programme management and the risk consultants to suppress or otherwise manipulate with the established practice. It was evident that all these actors were concerned with was to construct a practice that in the best possible way represented the underlying situation of the subprojects and the programme as a whole.

The paper's second key finding was that *performativity success could be achieved during times of misfires by reconfiguring the technical risk device, risk terminologies and the roles of the key actors of the practice*. The paper showed how this was evident, because the consultants operating the practice of risk management did not manage to curb the increasing 'value at risk' curve until the IT-based risk management control system had been adjusted. In this respect, the consultants altered the system's design and moved it from an Access-based platform managed centrally by the consultants to an online Internet-based platform. This allowed online access and gave all enrolled actors new user rights, such as individual access to the production of status reports, individual options for adding and deleting risk-related information, change of risk ownership between users without the involvement of consultants, etc. These changes to the IT-based control system were not sufficient, however, as the 'value at risk' curve continued to increase after the implementation of the changes. Consequently, the consultants incorporated new risk terminologies into the system, such as "approved" and "non-approved" risks, "overall risks" and "sub-risk", and only allowed "approved" risks and "overall risks" to be included. As this was still not enough, the consultants re-distributed the roles of the actors, something which they managed to do by reconfiguring specific user rights into the control system. After these measures had been taken, the

'value at risk' began to decrease again, as proposed by the implemented PMBOK-inspired framework.

The third finding continues along the actor-network theory way of thinking by asserting that *uncertainties will always be effects of the framing of any practice*. The paper showed that uncertainties were not "out there" to be brought into the programme through practices of risk management; rather they were produced through such (and other) practices. It might be that that which we know that we do not know can be defined as uncertainties, but they are not uncertainties *for* someone before they are brought into networks of associations. The paper showed this by describing some of the events that threatened the programme; these events were only considered risky because certain actors constructed them as such – and that only because these actors compared them against the pre-set/framed project objectives. The same goes for the practice of risk management: It follows from the findings that risk management also ended up producing unexpected uncertainties. This happened because of the way this practice was aligned with framed project objectives. Events that ended up affecting these objectives, but which had not been taken into account by the practice, or worse had been taken into account but had been rejected, created new unexpected uncertainties for the practice.

Where the second paper's third finding (the above) followed as a consequence of the findings related to the first two findings, the third paper sought to follow in more depth this linkage between (unexpected) uncertainties and risks under the conditions of managing large (mega) projects. More specifically, the third paper dealt with how practices of risk management shape project conditions, and with what ramifications for knowledge and project management roles. In carrying this out, the third paper extended the study to also include the Danish DKK 41.4-

billion Hospital Programme consisting of 16 unique hospital construction projects. All these projects are managed by independent project organisations and are scheduled to run from 2008 to 2020, depending on the individual project. The third paper also drew on actor-network theory and more specifically applied the concepts of framing and overflowing, where the first paper mainly drew on purification/inscription and the second paper mainly on performativity and misfires, even though these concepts are congruent (See Sections 6, 7 and 8 for references). Guided by this, the paper was structured into three sections: first, how the two cases' practices of risk management were framed; second, the overflows or unexpected uncertainties this produced; and third, tracing their relations across the two programmes.

The third paper made the key finding that *dominant risk management approaches neglect the wide range of uncertainties that emerge during project processes, and that overreliance on these approaches threaten the long-term value and effectiveness of the project*. The paper showed this by demonstrating that both programmes applied rationalistic risk management approaches by stressing cause-and-effect logics and probability times consequence logics. These programmes presupposed that knowledge was malleable to calculable rationales following the "traditional" cognitive-rationalist perspective. This meant that knowledge was perceived as an input into up-front planning and specification and that the purpose of risk management was to facilitate improved control with project objectives. Actors and organisations were reflexive and recognised the up-front uncertainty, ambiguity and complexity that characterise large (mega) projects, which tend to run for several years. However, it was much more difficult to grant legitimate existence to this reflexivity beyond the programmes' initial planning phases and into later project processes. The risk management frame here seemed to take on an active role by

emphasising control to ensure that the programmes progressed according to the pre-established plans and objectives. In this set-up, little or no legitimate role was left to reflexivity and knowledge production during project processes. This risk management frame in turn created the conditions for overflowing, emerging uncertainties and concerns.

The paper then demonstrated the emerging uncertainties that challenged project and risk management objectives and assumptions, as new knowledge about project objectives were produced during project processes. The paper described the activities of key project actors and how they performed risk management to the best of their ability, but how new and unexpected uncertainties emerged anyway. For example, the paper showed how a 'non-university' hospital construction unexpectedly turned out to be more complex than planned due to particular geological and archaeological conditions at the construction site. Nobody could have anticipated these conditions and the effects they would have, as knowledge of this required that comprehensive excavations be carried out later. The project and construction management team had anticipated that excavations might reveal something, but nobody could have known for sure that an unearthed dwelling would lead to a downsizing of the square metres available for the hospital and subsequent project design.[29] In this respect, the paper described many other unexpected uncertainties as well. It was evident that neither of the two studied programmes included project managers' hunches, feelings and concerns, nor any risks that might have an effect on other aspects than project costs, time and specification. The programmes thus gave primacy to consistency and integrity between project plans and outcomes, as

[29] Many other things than just archaeological excavations were at play, and the above is a simplified description of the situation, but there was no doubt that unforeseen events caused the initial project plans and thus the conditions for the project to be changed, something which the practice of risk management failed to take into account and which thus caused problems and challenges for the project management organisation.

if fundamental project uncertainties could be reduced to identifiable risks without any loss.

The paper also substantiated the finding by describing how there was more to the framing of risk management than individual people's calculated actions. It was evident from the two studied programmes that risk management was a distributed collective form of cognition and calculation. It was not just one or two actors who managed to mobilise the entire frame; this was the result of the collected effort of actors such as the National Audit Office, the Ministry of Finance, the different resort ministries, large consultancies, and local project managers. In complex and dynamic ways, these actor-networks together promoted practices of risk management, specified reporting standards, defined assessment metrics, etc. This created very strong networks of relations *across* the two programmes, *across* the public sector, which meant that individual project managers' feelings, concerns, etc., which these framed practices left no room to include, had trouble being acknowledged as legitimate risks to be included and taken seriously as risks. The paper thus also found *that current risk management frames with their corresponding assumptions about knowledge, predictability, and control come at the expense of innovation, novelty and intelligent outcomes*. The paper showed this by demonstrating how these emerging concerns were not seen as positive opportunities for rethinking the programmes, but as "noise" preventing effective risk management and the achievement of the (pre-set) objectives and conditions of the programmes.

The third paper concluded by proposing that frames of rationalistic risk management should be extended beyond the programme organisations carrying them out to also include those actors who are already part of the networks that promote them. This would for example be the National Audit Office. To practitioners, this

would acknowledge the distributed nature of risk management and serve as a first step towards developing more comprehensive frameworks that would also take uncertainties emerging during project processes into account. These are now being rejected and suppressed unless they fit into the existing established frames. The paper thus ended by challenging the commonly used "best-practice" risk management approach and argued that frameworks should embrace the broader notion of uncertainties. If this was done, it might produce significant benefits for the delivery and overall value of large capital investment programmes (and other types of projects / programmes organisations).

9.2. Contributions of this dissertation

This dissertation began by describing that risk management had proliferated as a worldwide state-of-the-art management control practice changing the very nature of what organisational management means across both the public and the private sector (e.g. Power, 2007). It described that the basic conception of risk management was that organisations could achieve increased certainty regarding the achievement of their objectives through the reduction of risks. It was also shown that this basic conception reflected an understanding of 'risks' as pre-existing in nature; as facts "out there" to be identified and controlled through scientific measurement and calculation and the knowledge produced through this. It was also shown that most organisations implemented practices of risk management inspired by the type of frameworks that incorporated the above conception, and which had risen to the status of "best-practice". In the review of the current risk management literature, however, it was demonstrated that this proliferation of risk management had taken place without much knowledge of the (empirical) effects that practices of risk management generate once they are implemented and put into operation. This claim was backed, by for example referring to numerous accounting and

management scholars who had called for research into the particularities of risk management practices (e.g. Bhimani, 2009; Gephart et al., 2009; Mikes, 2011; Miller et al., 2008; Power, 2009; Van der Stede, 2011; Vinnari & Skærbæk, 2014; Young, 2011).

In an examination of the implementation of a risk analysis method, Rocher (2011, p. 78), for example, stated: "It would be interesting in the future to study how translations continue to work once a [risk] management device is implemented in an organization". In reflection of the role of management accounting research in light of the recent financial crisis, Van der Stede (2011, p. 619) wrote: "After all, compelling evidence that governance, risk management, incentive systems and a myriad of other management (accounting) practices matter, and how they matter especially, will come from examining what really happens inside organizations." In describing how uncertainties also emerge from outside of the formal boundaries of current risk management frameworks, Miller et al. (2008, p. 962) asked: "But, if hybrids are where so much of the action is, and if so many social scientists from so many disciplines have emphasised their importance for two decades or more, why are they not given greater prominence in risk management?"; and in examining the uncertainties of risk management, Vinnari and Skærbæk (2014, p. 519) wrote: "We suggest that, in the future, more empirical case studies be conducted on the effects of risk management inscriptions by studying in greater detail how risk management systems are translated into organisational practices."

It was also commented by Gephart et al. (2009, p. 142) that "the potential of [the current risk management] theories to inform studies of risk and organization has not been fully developed or realized"; and Flyvbjerg (2011, p. 340) even wrote that it seemed as if current risk management theories had informed governments to

implement risk management in mega-projects on "weak theoretical grounds". In the literature, scholars were therefore bringing current risk management theories into question for being inadequate and/or incomplete and unable to explain the above-mentioned particularities of risk management practices. In being more specific about this situation, the review of current risk management literature led to the identification of four potential opportunities to advance our knowledge of risk management. The four avenues were: (1) studying the dynamics of risk management practices over longer periods of time; (2) examining the processes of translating uncertainties into "risk objects", focusing on the hybrid practices in which these processes take place; (3) looking into the enabling and constraining effects of technical risk devices; and (4) advancing accounting research into the study of risk management in large capital investment programmes (mega-projects).[30]

This dissertation contributes by addressing these four avenues through an examination of two case studies of large capital investment programmes and by following these over a longer period of time, and also going into the "messy" details of everyday interactions. The dissertation has thus on the one hand responded to the scholars within especially accounting research who called for research into the particularities of risk management practices and on the other sought to advance our understanding of practices of risk management in (public) mega-projects. The last subsection addressed the main findings of the three research papers; this subsection will now explain how this dissertation contributes to current academic (risk management) literature. This section further binds together the findings of the three research papers and the four avenues listed above with the overall research question, which was: How are practices of risk management in mega-

[30] See Section 3.3: "Implications, tensions and opportunities". These four avenues are non-exclusive, and there are more and interesting topics within risk management to focus on. These four stood out to me during my reading of the current risk management literature, however, which is why I have focused on them.

projects constructed, what effects are produced, and how can we understand them? The following three subsections should *not* be read as corresponding exactly in structure to the three research papers; the contributions go across these.

9.2.1. The translation of uncertainties into pure and impure risks

This dissertation first of all contributes to the academic literature on the relation between uncertainties (unmeasurable entities) and risks (measureable entities). The current risk management literature has shown that contemporary standards or frameworks of risk management tend to conflate this distinction (Froud, 2003; Winch & Maytorena, 2011). It has also been shown that solely relying on risk reduction to produce certainty can lead to unwanted consequences, such as loss of project relevance (Kreiner, 1995), the emergence of new and unexpected uncertainties (Vinnari & Skærbæk, 2014), a lack of broader value-orientation (Morris, 2010), and a false sense of control (Weick & Sutcliffe, 2001). The literature has also shown that managing uncertainties rather than exclusively risks may be more beneficial for organisations (Chapman & Ward, 2011), that the attention to matters of risks also takes place outside of formal and explicitly defined practices of risk management (Corvellec, 2009), and that uncertainties often emerge outside the limits of contemporary standardised frameworks of risk management (Miller et al., 2008). This literature, however, has largely not considered this distinction from a constructivist perspective and examined 'risks' as constructs or effects of (local) networks of relations (Callon et al., 2009; Hilgartner, 1992). This means that the current risk management literature has tended to disregard examining the actual processes of translating uncertainties into "risky" objects, including the things that happen during such processes.

This dissertation contributes to the above literature by looking into the distinction between uncertainties and risks and by taking the above constructivist perspective to examine actual processes of translating uncertainties into risks as they take place "in action". It contributes by introducing the distinction between *pure and impure risks*. This distinction does not just represent yet another analytical distinction; this distinction captures the finding that whether objects get classified as pure or impure generates different effects. The dissertation thus showed that some uncertainties were rejected as risks (impure risks) because the way they were constructed did not fit rationalist notions of 'risk', despite the finding that they were constructed and understood as such by local actors. As these local actors had to manage these risks on their own (they were still perceived by them as threats against their local subproject objectives), this became troublesome as they now lacked programme management attention and had to be taken care of on top of the local managers' other responsibilities. The distinction between pure and impure risks thus captures a so far by the current academic literature unexplored boundary-setting mechanism of risk management particularity. It points to the fact that practices of "best-practice" risk management are limited to the ways in which practices are constructed, which generate emerging new uncertainties that are not captured by them.[31]

The dissertation also examined the reasons why impure risks ended up being produced, which pointed to the mediating role of risk management inscription devices. In examining this aspect, the dissertation contributes to the ongoing academic

[31] I am not saying that impure risks *cannot* be dealt with. It was evident that they were sometimes translated back into risks (made pure); sometimes they were dealt with through locally constructed practices; sometimes through informal manager-to-employee chats and through legal claims. What I am saying is that impure risks *tend not* to be dealt with, and that is the whole point; they could have been, but are not, dealt with, and that is problematic for a practice that claims to be able to produce increased certainty; it now also creates uncertainty.

debate about the role of technical risk devices. It has been argued by some scholars that technical risk devices lie at the heart of practising risk management and that they represent key contingency variables for explaining the overall successful fit between organisations and environment (Beasley et al., 2005; Collier & Woods, 2011; Gordon et al., 2009; Kleffner et al., 2003; Liebenberg & Hoyt, 2003; Paape & Speklé, 2012). It has also been demonstrated that the adoption of technical risk devices can be explained by the work of experts, the culture of the organisation and/or pre-existing rationalities from already existing organisational (risk) practices (Arena et al., 2010; Mikes, 2009, 2011), and that these devices enable certain mechanisms such as the translation of disparate financial reports into comparable risk credit assessments or the confidence-building and resolution of different interests (e.g. Jordan et al., 2013; Kalthoff, 2005). This dissertation contributes to this string of research by demonstrating that technical risk devices (or in my case the IT-based risk management control system, also called the risk database), besides enabling risk management, also limit the boundaries of what can be accepted as (pure) risk and included into the practice. As a supplement to Mikes (2011), who examined the boundary-work of risk experts, this dissertation has thus shown that boundary-work also emerges as an unexpected effect of technical risk devices rather than only the intended work of human experts.

9.2.2. The performative effects of risk management frameworks

This dissertation also contributes to the accounting literature on performativity (e.g. Cushen, 2013; Dambrin & Robson, 2011; MacKenzie, 2006; Skærbæk & Tryggestad, 2010). This literature has shown that financial theories, accounting devices and economics can shape organisational practice and decision-making. This literature has further shown that situations also occur in which theories, models, devices, etc., produce the opposite effect, where these devices make practices

less like their depiction (MacKenzie, 2006, 2007). These latter situations are known as performativity misfires or counter-performativity (Callon, 2010; MacKenzie, 2006). The literature, however, has not yet examined the conditions under which misfires or counter-performativity can be overcome, or what is known as the conditions of performativity success during times of misfires (Butler, 2010; Callon, 2010). These conditions have been proposed as consisting of linguistic terminologies, social norms, institutional arrangements and material assemblages (Callon, 2007; Ferraro et al., 2005, 2009), but not empirically demonstrated. In the accounting literature and beyond, calls have therefore been made for research into the conditions of performativity success during times of misfires (e.g. Butler, 2010; Callon, 2010; Dambrin & Robson, 2011; Skærbæk & Tryggestad, 2010).

In response to the above calls for research, this dissertation makes two contributions to the current performativity literature: (1) it advances the study of performativity into the study of risk management, and (2) it demonstrates at least three key conditions and their linkages to re-establishing performativity success during times of misfires. In relation to the first point, the dissertation demonstrates the quite thought-provoking mechanism of risk management that certainty can be produced, not solely by reducing risky events, but by framing and re-framing the way risk management is practised. In relation to the second point, the dissertation demonstrates that reconfiguration of technical risk devices, risk terminologies and the roles of key actors is a key condition for performativity success during times of misfires. It also contributes by demonstrating the linkages between them during such times of misfires. It was evident that the reconfiguration of risk terminologies and risk roles was insufficient to re-stabilise the predictions of the implemented framework; these two mechanisms had to be adopted by the implemented control

system before successful performativity was achieved. This dissertation thus contributes by expanding our knowledge of performativity and its conditions.

9.2.3. The *processes* of risk management in mega-projects

Lastly, the dissertation contributes to the scarce literature that has looked into risk management in mega-projects. The current risk management literature that does exist has focused on explaining the reasons for the apparently common fact that mega-projects tend to incur cost overruns and turn into public expenditure scandals. This literature has shown how cost overruns can be explained by "optimism bias" (limited human cognitive capabilities) and "strategic misrepresentation" (political manipulation) during forecasting (e.g. Flyvbjerg, 2006; 2008; Lovallo & Kahneman, 2003). This includes promoting practices of risk management as institutional checks-and-balances to improve accountability and transparency and reduce incentives to manipulate such forecasts (Flyvbjerg, 2006, 2011). This literature has had an enormous effect on developments in public sectors around the world as governments, including the Danish government, have embraced the notion of "reference class forecasting". This literature, however, has based its findings on two things: comparisons of budgeted and total project costs, and psychological experiments. These approaches both reflect cognitive-rationalist approaches which focus on human beings as rationalistic information processing units and neglect the social context within which the practice of risk management takes place.

This dissertation contributes to this literature by pointing out that the *processes* of practising risk management cannot be overlooked, as these processes generate effects that influence both risk management and project conditions and objectives. On the basis of actor-network theory, the dissertation has demonstrated how risk

management must be understood not as individual cognitive phenomena, but as a distributed form of cognition and calculation that takes place in complex networks of relations. This enables the construction of risks, and the dissertation has found many risks to be identified, assessed and reduced; but it also limits the number of objects that can be considered "risky" due to its "super-rationalistic" knowledge assumption. Unexpected uncertainties emerged relating to both "softer" aspects such as prior experience, feelings, concerns, but also "harder" aspects such as events that had effects outside a narrow focus on "the enterprise" or "the project"; events that would cause political turmoil, and events that were "too small, too local and too specific" or outside "time, cost and scope". This dissertation thus contributes by pointing out that so-called "best-practice" risk management often comes at the expense of innovation, concern for the wider stakeholder environment, intelligent outcomes and novelty, and thus *risks* losing its wider societal relevance.

9.3. Implications

The findings of this dissertation have implications for the practising of contemporary "best-practice" risk management. In the academic literature, scholars have suggested that the standards of risk management disregard the broader notion of uncertainties, which means that certain uncertainty-reducing aspects are left out (e.g. Miller et al., 2008). It has even been suggested that contemporary risk management represent an "intellectual failure" due to its narrow functionalist and rationalist assumptions (e.g. Power, 2009). This dissertation showed that uncertainties (concerns, feelings and experiences) were indeed left out. This dissertation thus demonstrated that the logic of generic "best-practice" frameworks could indeed be described as "flawed". This dissertation also showed, however, that frameworks were considered relevant and useful despite being "flawed" (thus con-

firming Millo and MacKenzie's (2009) findings). If practitioners (and others), however, *believe* that frameworks are indeed able to take everything, or just all material uncertainties, into account, then this dissertation have shown that they most likely cannot. Not only has the dissertation shown that some uncertainties are excluded, but the dissertation has also shown that not all risks can be taken into account; some risks are systematically excluded and end up becoming what was termed impure.

But who holds those beliefs? I would have to say nobody. I have found no evidence to suggest that people did not reflect on this limitation; they all recognised that risk management was not some type of exact science that could ensure project conditions and objectives. Contrary to expectations, however, this just adds to the relevance of my findings. In this dissertation, I have shown that whether people believed that all material risks could be taken into account mattered little; what did matter was the way the practice had been framed, because no one attempted on their own to challenge the pre-established way of practising risk management, which was that all material uncertainties had to be included. The project managers would say that they believed that because the consultants were the experts, they knew what was best; the consultants would say that they did what everybody else were doing; the programme management would say they were adhering to government ministries' requirements; and the governing ministries would say that numbers mattered little, progress mattered more. In this setup, however, because the numbers *were* produced, they came to *represent* the practice, they came to *symbolise progress* which again signified the level of certainty produced. And because nobody could disagree with the fact that more certainty was better than less, those numbers, or more specific the 'value at risk' curve, was rarely challenged and disputed.

As the technical risk devices were important actors in understanding the construction and framing of the practice of risk management and the subsequent systematic exclusion of certain types of risks, I argue that practitioners should pay careful attention to the ways in which they construct and apply such practices. I am not saying that 'uncertainties' and 'risks' are not managed outside of formal practices of risk management. In practice, even impure risks might be taken care of through other types of practices such as value management or claim management. I am arguing, however, that nobody can be satisfied with having practices, albeit "best-practice" ones, that systematically exclude certain elements, in this case certain risks, which might be included by structuring the practice differently. According to my findings, it thus follows that organisations may benefit from supplementing "best-practice" risk devices with another dimension that is not structured by strict "scientific measurement", but which acknowledges the deeply social, political and cultural dimensions of constructing risks. As I have shown, risks are not "out there"; practitioners construct risks "in here", and when they do, they equip themselves with calculative devices (see also Callon, 1998b).

Such a new dimension could be the inclusion of the broader notion of 'uncertainties', the things we know we do not know, like experienced project managers' gut feelings and intuition, or stakeholders' more broad concerns of the societal relevance of projects. These 'uncertainties' are by definition non-calculable (otherwise they would be risks) and thus cannot be molded by rationalist assumptions of probabilities and consequences. The fact that they cannot be subjected like this to rationalistic ideas of calculation, however, does not mean that they cannot be spoken about, described, written down, acted upon and reported on to governing ministries. The first step would therefore be to actually integrate this dimension into

the technical risk devices as they perform the practice they describe through their application. If this is to have any effect, however, it would also require that key public governing actors recognised the distributed nature of the practices of risk management beyond actual projects. It followed from the third paper that due to the strong influence of the National Audit Office and the Ministry of Finance, who had enforced "best-practice" risk management, this meant that the two programmes also did their very best to carry out risk management as required. It can therefore also be assumed that these actors need to accept the role assigned to them and either take the lead in redeveloping risk management or at least not prevent others from doing so.

In relation to the broader notion of uncertainties and the responsibilities of actors, this leads to an important aspect of 'risk' and 'risk management' that has not been dealt with in this dissertation. This aspect concerns the relation between risk and blame (e.g. Douglas, 1985; Hood, 2002; Skærbæk & Christensen, forthcoming). In my research for the three papers, I found no evidence to support the theory that 'blame games' were taking place, but I did find much evidence to support that practices were being constructed around notions of distributing roles and thus also responsibility. It followed that terminologies like "risk owners" or "risk managers" were invented to frame an effective process of practising risk management. In theory, this means that actors may end up taking the blame for events included into the control system of which they were listed as the risk owners. All things being equal, this may make sense because project managers are responsible for their subprojects, but when it is taken into consideration that certain types of risks are excluded in spite of the fact that they have been found relevant as such by those same project managers, this becomes troublesome. In theory, they are now respon-

sible for risks that have been excluded, and as shown, such exclusion means that those risks are difficult to manage and thus often end up not being managed.

In light of traditional managerial thought, both the two programmes followed did not calculate the breakeven of the costs and benefits of practising risk management. As pointed out by the actors spoken with, however, this was also very difficult to estimate because risks that had been prevented, and thus that had not occurred, could not be monetised. It was therefore difficult to figure out what the costs were of achieving the benefits of having formal meetings, an IT-based risk management control system, several consultants employed etc. All one was left with was the statement that when management was satisfied, the extent to which risk management was applied had to be appropriate. It can only be assumed, however, especially when one looks across the public sectors at large, that these costs must be substantial. It can therefore be speculated as to whether breakeven has been met or whether perhaps too much money are being spent on risk management public sector-wide compared to its realised benefits.

In summary I argue that practitioners need to be aware of the limitations of risk management up front and develop more unstructured approaches to supplement the more cognitive-rationalist generic "best-practice" frameworks. This may enable such aspects as improved opportunities for learning, novelty and invention, and might, at least for public mega-projects specifically, benefit society, projects and consultancies to a larger degree. I am well aware that this will require dealing with many years of cognitive-rationalist thinking about the purpose of risk and project management, but when such projects reach a size where no one can foresee what will happen, it makes little sense to insist on pre-set objectives. More open

and flexible approaches are necessary – at least according to the findings in this dissertation.

9.4. Limitations

This dissertation can be said to have its limitations. The first one is the fact that I rely on case studies as my method. If one believes that science should be about proving or predicting things, then my research can be severely criticised for not doing that. In relying on case studies, I have not collected enough data across mega-projects (or other types of organisations) to be able to generalise, and consequently I could be criticised for not being able to predict anything. In this sense, this dissertation is explorative and hypothesis-generating and lacks the sample size to be much else. In contrast, however, if one believes that science should be about promoting opportunities for learning, then I would argue that choosing (two) case studies does not seem like such a bad choice. This has enabled me to provide context-specific knowledge which seems most relevant for both academics and practitioners seeking to understand and learn more about "the particularities of risk management practices". On the one hand I thus accept the limitation that I am unable to generalise, but on the other hand I reject the criticism that this should be the only purpose of theory, and thus also of making strong contributions.

The second limitation concerns the fact that I have done only two and not more case studies, according to the logic that more must always be better than fewer case studies. In response to this, I do agree that more case studies, again, would provide me with better opportunities for generalising upon my findings, but I disagree that case studies still cannot generate interesting contributions and opportunities for learning. That depends on the case studies chosen. In this dissertation, I have chosen the Signalling Programme because this programme was the first Dan-

ish programme legally subjected to holistic risk management requirements and not just because this case represented "yet another one". It thus represented what has often on a more positivist note been termed a "paradigmatic case".[32] It was further evident from talks with key actors from various ministries and public agencies that many other agencies were in the process of adopting the Signalling Programme's way of approaching risk management, because they considered it the best-practice way to carry out risk management. In relation to my findings here, this means that lessons learned from this case study are likely to also be relevant to what is happening elsewhere in the Danish public sector – which again means that investigating only one case (or two) does not a priori imply limited relevance of findings.

The third limitation refers to that of telling narratives. In this dissertation I have told stories about the construction of two practices of risk management (although one in more detail than the other) and the effects they generated over time. In doing this, there will always be an element of subjectivity, as I had to interpret what the actors were saying and represent this in my selection and account of those stories. I also had to decide which actors I engaged with, as I could not read all documents, interview all actors or observe everything at all times. Even though I took my precautions and gathered as much information I could from as many actors as possible, there will always be the risk that had I just collected one more piece of information, then that would have changed my understanding of what happened. In a response to this, however, my claim is that all methods suffer from a degree

[32] If one focuses on the role of consultants, the Signalling Programme represents an "extreme case" as well, as no other Danish project before this has spent such large sums on consultancy fees. In contrast, if one focuses on the application of current worldwide "best-practice" risk management frameworks, then this case also can be considered a "critical case", as it may "falsify" or "verify" the predictions of the framework. This whole distinction between different types of case studies therefore depends on the perspective taken, and also to a certain extent goes against actor-network theory's "criteria" for selecting case studies (see Section 5.2.).

of subjectivity; even quantitative methods require choices to be taken, hypotheses to be decided upon and data-analysing techniques to be carried out. At least I had the opportunity to consult with the actors I observed after I observed them and before writing the papers and this dissertation.[33]

The fourth and last limitation concerns the specific aspects of risk management that I decided not to collect information on, despite the fact that this could also have been relevant. In this respect, two such aspects should be mentioned. The first relates to the fact that I made the decision not to follow the actual day-to-day work of project managers. As I described above, I decided not to do so because it only added little to my knowledge of risk management. I cannot eliminate the possibility that this could have revealed interesting findings. The second relates to the fact that I ended up not systematically following how actors actually carried out their risk-reducing actions. I followed how they decided upon them, the types of actions they decided upon, the result of having carried them out, and when, where and with whom they were carried out. I quickly realised, however, that thousands of such actions were being carried out, that these involved even more actors, and that most of them took place at the same time. For practical reasons, it was thus too difficult to follow these actions systematically. It would have been fruitful to do so, however, as this could have advanced our knowledge of the more specific trajectories that pure and impure risks take after their initial construction.

9.5. Future research

Overall, I recommend that still more research be conducted into "the particularities of risk management practices" that scholars in risk management have called

[33] I have had reflections on this earlier in the dissertation, as there are opportunities to be gained, but also potential negative effects, which means that one has to strike a balance (see Section 5.4 with subsections).

for. In this dissertation, I have provided rich and detailed descriptions of risk management practices by following two such practices over four years (and still continue to do so). This means that all empirical findings will be local and related to those cases and thus that still more opportunities exist to promote our knowledge of risk management practices. This could be done by examining more mega-project risk management practices, carrying out comparative case studies across countries, examining other types of organisations as well, etc. In these years, mega-projects are undergoing large changes in project and risk management, such as with the introduction of "reference class forecasting". It might therefore still be beneficial to carry out more case studies in this area. That could be from a perspective of examining the translation of uncertainties into risks, the relationship between frameworks and practices of risk management, and the effects on knowledge and project management roles; but it might also be by examining other aspects, such as the outsourcing of risks or the interface between risk management, and other project management practices, such as value-based management or quality management.

It might also be beneficial to supplement the actor-network theory concepts I have drawn upon with different actor-network theory concepts in order to shed light on different mechanisms of risk management practices. I have relied primarily on the concepts of framing, overflowing, purification, inscription and performativity, but there are also other concepts, such as action-at-a-distance, matters of concern, the four moments of translation, and trials. In this dissertation I have focused on specific programmes (mega-projects) rather than the public sector at large and the developments taking place across public sector actors. In these years, standardisation appears to emerge, driven by consultancies, on how to do risk management across all types of public capital investment programme. A more specific future avenue

of research could be following the work of consultancies implementing that standardisation process across public sector entities and the effects this has on management control practices. The above-mentioned concept could add to the findings of this dissertation by shedding light on, for example, relations of maintaining central government control, or by analysing 'blame games' when the project goes wrong. Hence, there are still many more interesting avenues to examine, and actor-network theory could be applied as one of them.

In relation to the first paper, I recommend more research be conducted into the translation of uncertainties into pure and impure risks in order to examine the extent of this effect and how it is related to organisational objectives and conditions. This could be extended by taking into account more organisations across countries and sectors and/or by following the relationship between events taking place and their relation to pure and impure risks. This would provide new opportunities for learning more about the dynamics of risk management practice and allow more generalisable empirical findings. In this respect, the first paper established that four types of risks were excluded as impure for the practice. It would be interesting to learn more about other types of impure risks, and I therefore also recommend that more research be conducted along this line of inquiry. As I do not claim that these types of impure risks will be the only ones found across all types of organisations, but because I do claim that impure risks are effects of technical risk devices, this research could pursue following whether linkages exist between different types of technical risk devices and different types of impure risks. This research could also in more detail follow the dynamic linkages between how risks are constructed as pure and impure and how such risks are managed over longer periods of time.

I also recommend that more research be conducted into the relationship between frameworks and practices of risk management. If frameworks can shape how risk management ends up being carried out, which the second paper showed, then this might be an avenue for developing more embracing frameworks. These frameworks could open up to a broader understanding of 'risk' and 'uncertainty', which in turn could allow a broader and more dynamic practice of uncertainty/risk management. This would allow such aspects like concerns, feelings, hunches, gut-feelings, etc., which are now being excluded, to be included, which then could be used to expand the view on project conditions (see previous section). In the two case studies carried out here, risk management served the purpose of preventing "bad things" from happening to already pre-existing project objectives and conditions. In contrast, extending risk management frameworks could allow a redefinition of project and risk management roles to also encompass possibilities for redesigning project conditions, the introduction of new ideas, new inventions etc. And because frameworks have performative effects, this means that practices would, at least theoretically, adapt to these extended framework predictions, that is, be more open to the larger notion of 'uncertainties' rather than to the narrow one of 'risks'.

I acknowledge that actor-network theory has certain limitations. One of them would be that inventing new normative frameworks of risk management requires supplementing the actor-network theory perspective. In actor-network theory the actors, not the observers, are in charge of the world-defining activity, which means that research that remains loyal to actor-network theory principles becomes descriptive.[34] Further research could therefore supplement the findings here with dif-

[34] The above statement is a bit simplistic, as actor-network theory claims (1) that also observers participate in the construction of the network they describe, which means that they also must be understood as actors and thus all things being equal must also be able to produce their own world-definitions; but (2) that this is a complex issue, be-

ferent theoretical perspectives (and methods) to develop such normative frameworks. This would serve both to advance current knowledge of how to approach risk management, but also to provide practitioners with new techniques, new devices, and new tools. One requirement would be to let go of the strict cause-and-effect logic (the cognitive-rationalist approach to human perception of risk) and embrace the broader notion of uncertainty by facilitating looser "risk" descriptions. Another requirement would be to let go of the inscription of the multitude of conversations, controversies and conflicts into one-figure values or color-coding that takes place in any practising of risk management. This serves to highlight certain aspects, but it comes at the expense of the complexity of practice in which uncertainties emerge and should not be suppressed to meet "scientific measurement models".

To sum up, in my opinion there is still much more to learn about risk management, and future research must insist on going into practice to flesh out these mechanisms. With this dissertation, I have described how practices of risk management can be constructed, including what effects such practices produce and how we can understand them, but there are many more practices out there which generate effects. I can only hope now that others will take the lessons learned from this dissertation and pursue this line of research to build upon my findings, but also to supplement them (dare I say translate them!) with new findings. In the words of Frank Knight, whom I quoted at the beginning of this section: "It is a world of change in which we live, and a world of uncertainty. We live only by knowing something about the future; while the problems of life, or of conduct at least, arise from the fact that we know so little". But rather than attempting to reduce uncer-

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cause actors are those who are allowed to be so by other actors, which necessitates that the observer's normative statements must be defined as such by yet a third actor and not himself. See Latour (2005).

tainty, and through this turn uncertainty into “the problem of life”, let us instead embrace the things “we know that we do not know”, work *with* uncertainty, turn it into opportunities; let us reinvent how we deal with risks; let us make models that are useful and relevant rather than “accurate”; and let us be guided by practice and pursue the vast amount of knowledge that can be learned from them.

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11. Appendices

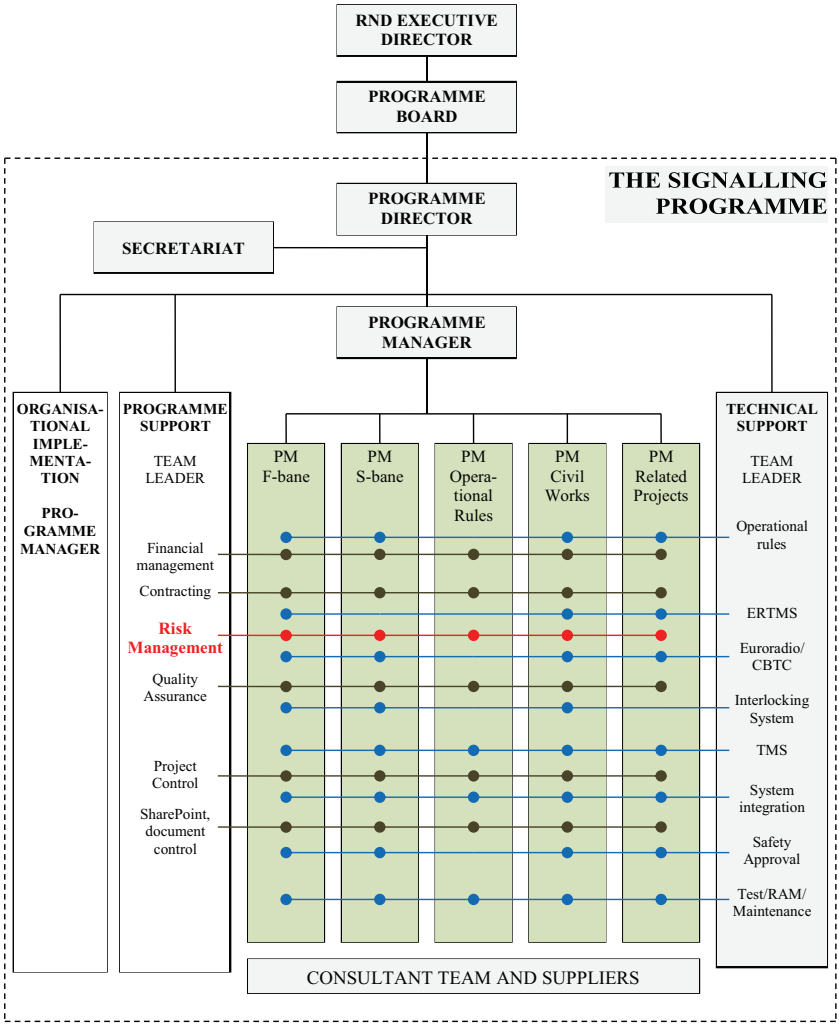
11.1. Appendix 1: Annual Danish capital appropriations 2005 – 2014

The following table shows the annual Danish capital appropriations from 2005 to 2014 (Forslag til Finanslov / FFL) and the Danish Ministry of Transport's (MoT) share of these. It demonstrates two notable things: first: annual capital appropriations have approx. quadrupled over the course of the years; and second: the Ministry of Transport has on average received approx. 80 per cent of all annual capital appropriations. It should be noted that the numbers do not represent *actual,* but only *budgeted*, capital expenditure, as additional, or extra, appropriations given during the years, potential relocation of funds between capital and operational accounts, and unused funds due to capital savings have not been included. This, however, does not affect the overall two trends described above.

Danish Annual Capital Appropriations	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**Avg.**
FFL (MDKK)	4.582	5.145	7.282	7.317	8.588	11.768	10.351	14.714	17.353	19.034	106.133
MoT share (MDKK)	2.402	2.287	4.880	6.114	7.078	9.794	9.301	14.184	15.484	13.835	85.358
MoT share (percentage)	52	44	67	84	82	83	90	96	89	73	80

Source: The information has been gathered from the Ministry of Finance's Financial Act Database (See: http://oes-cs.dk/olapdatabase/finanslov/index.cgi). The following search criteria were employed: "Bevillingslov: Forslag til Finanslov (FFL), Overramme: Anlægsramme". Latest search date: 1 September 2014.

11.2. Appendix 2: Signalling Programme, organisational chart



Source: Hand-out from I1, but see also Banedanmark (2008a, p. 182)

11.3. Appendix 3: Signalling Programme, timetable

Signalling Programme, Timetable													
Years	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Fjernbane 2021	Procurement (3 years)			Design (3 years)			Test (3 years)			Roll-out (4 years)			
S-bane 2020	Procurement (2 years)		Design (2 years)		Test (2 years)		Roll-out (6 years)						

Source: Banedanmark (2009a)

11.4. Appendix 4: Signalling Programme, 'traffic light assessment matrix'

Risk ranking matrix			Consequence				
			Very low	Low	Moder-ate	High	Very high
			1	2	3	5	8
Frequency	Almost certain	6	6	12	18	30	48
	Highly likely	4	4	8	12	20	32
	Likely	3	3	6	9	15	24
	Unlikely	2	2	4	6	10	16
	Very un-likely	1	1	2	3	5	8

Source: (Banedanmark, 2008c, p. 49)

11.5. Appendix 5: Signalling Programme, risk classification

Risk Classification					
Consequence	**Very low**	**Low**	**Moderate**	**High**	**Very high**
Cost F-bane (MDKK)	< 15	15 – 150	150 – 750	750 – 1500	≥ 1500
Cost S-bane (MDKK)	< 3	3 – 30	30 – 150	150 – 300	≥ 300
Time (Month)	< 1	1 – 3	3 – 6	6 – 12	≥ 12
Punctuality F-bane	< 0.1 %	0.1 – 0.5 %	0.5 – 1.0 %	1.0 – 2.0 %	≥ 2.0 %
Punctuality S-bane	< 0.05 %	0.05 – 0.2 %	0.2 – 0.4 %	0.4 – 0.7 %	≥ 0.7 %
Benefits	Minimal or no consequence to technical performance or benefits.	Minor reduction in technical performance or supportability. Minor impact to benefits.	Moderate reduction in technical performance or supportability. Moderate impact to benefits.	Significant degradation in technical performance or major shortfall in supportability. One of the four benefits will not be achieved.	Severe degradation in technical performance. More than one of the four benefits will not be achieved.
BDK-credibility	Minimal or no consequence towards credibility.	Minor degradation in credibility in Ministry and among major stakeholders.	Minor degradation in credibility in Ministry and among major stakeholders. Beginning lack of confidence from Ministry and major stakeholders towards BDK.	Significant degradation in credibility in Ministry and among major stakeholders. Lack of confidence from Ministry and major stakeholders towards BDK.	Severe degradation in credibility in Ministry and among major stakeholders. The signalling programme under administration by the Ministry.
Probability	**Very unlikely**	**Unlikely**	**Likely**	**Highly likely**	**Almost certain**
Numerical	<0.01	0,01 – 0.05	0,05 – 0,2	0,2 – 0,65	0.65 – 1

Source: Banedanmark (2009b, pp. 20-24 [own making])

11.6. Appendix 6: Observation studies

No.	Type	Project	Length	Month	Year
O1	Operational risk meeting	S-banen	01:52	May	2010
O2	Operational risk meeting	GSM-R	01:15	June	-
O3	Operational risk meeting	SPOR 20	01:56	June	-
O4	Operational risk meeting	OI	01:14	June	-
O5	Operational risk meeting	PMO	01:22	Aug.	-
O6	Operational risk meeting	On-board	01:50	Aug.	-
O7	Operational risk meeting	F-banen	02:20	Aug.	2011
O8	Cross-risk review meeting	All	01:32	Aug.	-
O9	Operational risk meeting	Prog. dir. + sec.	00:40	Sep.	-
O10	Operational risk meeting	SPOR 20	01:43	Sep.	-
O11	Operational risk meeting	Civil works	00:14	Dec.	-
O12	Operational risk meeting	STM	01:22	Dec.	-
O13	Operational risk meeting	GSM-R	02:24	Jan.	2012
O14	Operational risk meeting	F-banen	02:28	Jan.	-
O15	Risk workshop	GSM-R	02:21	Feb.	-
O16	Operational risk meeting	PMO	00:39	Mar.	-
O17	Operational risk meeting	Prog. dir. + sec.	00:56	Mar.	-
O18	Risk workshop	F-bane east	04:27	Nov.	-
O19	Operational risk meeting	F-banen	00:37	Sep.	2013
O20	Risk forum	Risk man. Team	01:24	Sep.	-
O21	Operational risk meeting	Prog. dir. + sec.	01:16	Sep.	-
O22	Risk forum	Risk man. Team	01:21	Oct.	-
O23	Risk sharing meeting	RND + DSB	01:30	Oct.	-
O24	Risk forum	Risk man. Team	00:49	Nov.	-
O25	Risk approval meeting	F-banen	00:38	Dec.	-
O26	Risk approval meeting	S-banen	00:42	Dec.	-
O27	Operational risk meeting	F-banen west	00:34	Dec.	-
O28	Operational risk meeting	Safety	01:01	Dec.	-
O29	Risk status meeting	S-banen	00:41	Feb.	2014
O30	Operational risk meeting	OHS	00:55	April	-
O31	Risk status meeting	S-banen	00:28	April	-
O32	Operational risk meeting	PMO	01:02	April	-
O33	Operational risk meeting	OI	01:30	April	-
O34	Operational risk meeting	Prog. dir. + sec.	00:59	May	-

O35	Risk forum	Risk man. Team	01:00	May	-
O36	Risk forum	Risk man. Team	00:59	June	-
O37	Cross-risk review meeting	All	01:12	June	-
O38	Operational risk meeting	PMO	00:18	June	-
O39	Operational risk meeting	OHS	01:13	July	-
O40	Operational risk meeting	Prog. dir. + sec.	01:13	July	-
O41	Risk forum	Risk man. Team	01:04	Aug.	-

11.7. Appendix 7: Observed people

No.	Title	Employer
X1	Risk Manager	Banedanmark, SP
X2	Head Senior Risk Consultant	Ramboll
X3	Head Project Manager	Banedanmark, SP, S-banen
X4	Program Director	Banedanmark, SP
X5	Civil Servant	Ministry of Transport
X6	Head Project Manager	Banedanmark, SP, OI
X7	Vice Senior Risk Consultant	Ramboll
X8	Project Management Consultant	Parsons
X9	Financial Controller	Banedanmark
X10	Project Manager	Banedanmark, SP, GSM-R
X11	Project Manager	Banedanmark, SP, GSM-R
X12	Project Management Consultant	PA Consulting
X13	Head Project Manager	Banedanmark, SP, SPOR 20
X14	Project Management Consultant	Atkins
X15	Project Manager	Banedanmark, SP, OI
X16	Programme Manager / End-to-End Manager	Banedanmark, SP
X17	Joint Venture Senior Executive Consultant	Ramboll
X18	Project & Risk Management Consultant	Atkins
X19	Head Project Manager	Banedanmark, SP, On-board
X20	Risk Consultant Trainee	Ramboll
X21	Head of Finance	Banedanmark
X22	Project Manager / End-To-End Manager	Banedanmark, SP, F-banen
X23	Project Manager, Chief Engineer	Banedanmark, SP, F-banen
X24	Head of Safety	Banedanmark, SP
X25	Head of Secretariat, Senior Consultant	Banedanmark, SP
X26	Project Director (Head Project Manager + Consultant)	Ramboll, Civil Works
X27	Project Management Consultant	Atkins, STM
X28	Project Manager	Banedanmark, SP, Tech. Sup.

X29	Systems Manager	Banedanmark, SP, GSM-R
X30	Project Manager	Banedanmark, SP, GSM-R Data
X31	Head Project Manager	Banedanmark, SP, GSM-R
X32	Project Manager / Risk Manager	Banedanmark (not SP)
X33	Budget Consultant (Geschäftsführer, Mitglied des Verwaltungsrates)	R+R, Burger und Partner AG
X34	Project Management Consultant	NNE Pharmaplan, GSM-R
X35	IT Project Manager	Banedanmark, Teknisk Drift
X36	Transmissions Manager	Banedanmark, Teknisk Drift
X37	Head of IT Operations	Banedanmark, Teknisk Drift
X38	Senior Project Consultant	Jan Saugen AS, Oslo, Norway
X39	Project Manager, GSM-R Private Railways	Banedanmark, SP
X40	Programme Planner	Banedanmark, SP
X41	Project Manager	Banedanmark
X42	Director (also Head Risk Manager)	Systems Railway Solutions, Supplier, F-banen East
X43	Project Migration Manager (Installation and Commissioning)	Alstom, Supplier, F-banen East
X44	Traffic Management System Consultant	Ramboll JV
X45	Project Manager	Banedanmark, SP
X46	System Integration Manager	Banedanmark, SP
X47	Project Quality Safety Manager	Alstom, Supplier
X48	Deputy Design and Development Design Consultant	Ramboll JV
X49	Scheduler / Time Manager, Consultant	Ramboll JV
X50	Project Manager	Alstom, Supplier, F-banen East
X51	Senior Chief Consultant, Safety Management	Ramboll
X52	Contract Management Consultant	Atkins
X53	Contract Manager	Alstom, Supplier
X54	Chief Execute Officer (CEO)	Banedanmark

X55	Project Management Consultant	*Unknown*
X56	Migration Management Consultant	Atkins Denmark
X57	Risk Consultant	Ramboll
X58	Project Controls Manager	Banedanmark, SP, S-banen
X59	Project Controls Manager	Banedanmark, SP, On-board
X60	Project Manager	Banedanmark
X61	Risk Manager	DSB, Stakeholder
X62	Project Manager	DSB, S-banen, Stakeholder
X63	Project Manager	DSB, F-banen, Stakeholder
X64	Deputy Project Manager and Risk Manager	Thales-BBK, Supplier, F-banen West
X65	Project Manager	Banedanmark, SP, F-banen West
X66	Head Safety Manager + Consultant	Banedanmark, SP, Safety
X67	Safety Management Consultant	Banedanmark, SP, Safety
X68	Project Manager	Banedanmark, SP, OHS
X69	Project Manager	Banedanmark, SP, OHS
X70	Planning Management Consultant	Ramboll
X71	Head Quality Manager	Banedanmark, SP
X72	Governance and IT management Consultant	Partner, Quant APS + Owner, Tuesdays APS
X73	Project Manager	Banedanmark, SP, OI
X74	Senior Consultant	Banedanmark, SP, OI
X75	Organisation Development Consultant	Qant APS, Partner
X76	Change Management Consultant	OI, SP, BDK
X77	Project Manager, Risk Manager	Banedanmark, SP, On-board
X78	Risk Consultant	Ramboll
X79	Risk Consultant	Ramboll

Note: The names of the above persons, including when and where I met them, and how many times I have met them, have been anonymised for reasons of confidentiality.

11.8. Appendix 8: Interviews

No.	Interviewee	Interviewer	Length
I1	Risk Manager	Tim Neerup Themsen	01:43:57
I2	Senior Risk Consultant	-	01:05:56
I3	Head Project Manager	-	00:27:25
I4	Programme Director	-	01:14:07
I5	Civil Servant	-	01:02:54
I6	Head Project Manager	-	01:06:30
I7	Senior Consultant	-	01:34:25
I8	Head of Finance	-	00:50:16
I9	Head Project Manager	-	01:19:32
I10	Financial Consultant	-	00:53:05
I11	Safety Manager	-	01:12:45
I12	Risk Consultant	-	01:22:19
I13	Civil Servant	-	01:03:50
I14	Civil Servant	-	01:07:05
I15	Supplier	-	01:19:55
I16	Risk Consultant	-	01:18:22
I17	Project Manager	-	01:06:04
I18	Head of Secretariat	-	01:44:59
I19	Governance Manager	-	01:22:55

Note: The names and initials of the above persons, including when and where I met them, and how many times I have met them, have been anonymised for reasons of confidentiality.

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