Coping with unknown unknowns and perverting effects. An introduction to the crisis of risks management in public infrastructure management

Paper presented in the panel The Crisis of Risk Management in Public Infrastructure, IRSPM Conference 2010, 7-9 April 2010, Berne, Swiss.

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Introduction

As the world economy is slowly recovering from the financial crisis countless analyses have been drafted about the how and why of this crisis. By now, the terms, systemic risks, systemic failure and complex financial products seem able to convey the deeper causes of the financial crisis to most of us. Basically, many critics have analyzed how in the financial market, risks were externalized and remodeled into new financial products to the extent that nobody knew what risks they were running. The sheer complexity of the financial instruments that were created meant that no single actor was able to assess the true risk to which they were exposed. Furthermore, the aggregate problem was that nobody knew that the financial system as a whole was exposed as a result of this problem. The financial system had not been designed nor envisaged to have to cope with the conditions that occurred during the financial crisis. As such, the financial shocks and turmoil that hit the financial markets may be regarded as a highly complex, unpredictable and improbable phenomenon. The problems of late seem a grim reminder of the inherent unpredictability of the economy.

What is disturbing is that increasingly, more and more of these low probability/high-impact events seem to occur in a variety of sectors and industries. These events have been nick-named 'Black swans' (Taleb, 2007). "In the field of energy provision, public transport, health, financial services and large-scale infrastructure there have been major public crises" and governments have become aware of "big system and project failures, and the vulnerabilities they create" (Power, 2004:11). These crises were the result of systemic failures. As governments play an important role in the safeguarding of society against systemic risks, an

important question is whether governments are capable of adequately identifying and dealing with these 'black swans' and unexpected events and whether governments are adequately managing these systemic risks.

On a smaller scale, similar problems to occur in the world of infrastructures. With infrastructures, we mean a set of large-scale technical systems that provide essential services such as the water, electricity and transportation systems as well as the internet. Either, during their construction (e.g. Amsterdam and Cologne subway construction failures, 2008/2009; the financing of infrastructure projects, cf. Priemus et al., 2008; Flyvbjerg et al., 2003; (Ng and Loosemore, 2007)) or during the operational phase (e.g. California electricity crisis, 2000/2001; cf. De Bruijne, 2006; 2009; problems in other electricity markets, cf. Woo et al., 2003; incidents in the English Railway industry, cf. Cullen 2001a; 2001b) unexpected events seem to defeat the risk management methods that guide the projects and operations in these infrastructures (cf. Weick & Sutcliffe, 2001). In response to incidents of this nature, public organizations have oftentimes been required to move in and assume (financial) responsibilities to prevent further damages. Problems in a range of western countries and a variety of infrastructures raise suspicions that we are dealing with systemic problems and not isolated incidents. This makes the analogy with the financial crisis an interesting point of departure.

Governments increasingly seem unable to adequately assess and predict the risks that modern day society is exposed to. A lot of the risks that are inherently present in large scale infrastructure projects remain unobserved or unknown until they 'occur'. It seems as though governments in today's world are confronted with more risks, than they are able to cope with.[1] But what does this mean for the management of risks. Are governments unable to adequately manage risks in infrastructure industries? What valuable lessons can be learned from the financial crisis? What can we learn about the financial crisis for the management of large scale projects? And more specifically for the management of risk?

In this paper we will focus specifically on large infrastructure construction projects. One of the reasons to tackle these projects in particular is that the size of failure costs for these particular projects is particularly high (cf. Van Staveren, 2006:16-17).

[1] However, "the evidence that the world is more risky or dangerous is at best equivocal" (Powers, 2004:38).

On the crisis of 'traditional' risk management

One of the key questions is how governments and public institutions currently seek to manage risks in large public infrastructure projects. Obviously, 'traditional' risk management tools are proposed as the instruments to identify potential hazards by identifying their probability of occurrence and the magnitude of the impact (cf. Williams, 1995).

However, current risk management systems seem unable to fully incorporate all the complexities and uncertainties that characterize modern day social systems and the management methods that are used to control those potential risks. A number of characteristics may identify why this is the case.[2]

- First of all, risk management is the management of expectations and (only) deals with the analysis of hazards that can be identified and 'foreseen'. The risk management tools are very well able to identify risks that are known. For some projects and types of risks, this is simply not the case (cf. Atkinson et al., 2006). There remain so-called unknown unknowns (cf. Longstaff, 2005). Unforeseen risks are those that are not taken into account during the risk management process and "are typically located outside the circle of influence of all project stakeholders" (Van Staveren, 2006:36). Examples of well-known risks in large-scale public infrastructure projects include long-established infrastructure designs (i.e. proven technology), which logically contrast to more innovative and radical designs that create uncertainties (i.e. "the absence of information about parts of a system under consideration" (Van Staveren, 2006:26)).
- Secondly, even by looking at risks, past events may be insufficient predictors of the future. According to Taleb (2007), the relatively small amount of knowledge that we have that would predict low probability/high impact events is often insufficient too. Our knowledge from the past therefore seems to provide little comfort to plan for the future. This is especially treacherous as the majority of large-infrastructure projects of contain elements of innovative design and management. Most infrastructure projects are unique, and especially in the construction of large-scale projects, unique constellations of actors emerge to work on these projects. The interaction effects between new elements in designs and proven technologies or procedures are a case in point and redefine the risks that are present (cf. Petroski, 1992).

[2] Here a number of these issues are identified, but the list is not meant to be exhaustive.

- Thirdly, “risk management is much more than a technical analytical practice; it also embodies significant values and ideals, not least of accountability and responsibility” (Powers, 2004:11)(Kutsch and Hall, 2010). A fundamental assumption underlying risk management is that information about risks is present and that risks can be attributed to specific actors. Especially in large-scale infrastructure projects, experiences have taught us to recognize the complexity of large-scale infrastructure projects and the institutional fragmentation of the construction industry which has resulted in a nested and layered structure in which contractors, subcontractors and free-lance specialists ‘partner up’ together to design, build (and/or exploit) infrastructures. Large-scale infrastructure projects are often composed of public-private consortia’s in which numerous parties play an important role with regard to risks. The planning and construction of large scale infrastructure projects have evolved into complex projects with large numbers of actors involved. In large infrastructure projects risks are spread out among the number of actors involved in the project, which blurs the image. The knowledge of the project and its characteristics becomes fragmented across a large number of actors that are unable to identify all the (potential) interdependencies and risks that are involved in the changing of a single (sub)parameter in the infrastructure design phase. Unclear is who bears what responsibility with regard to specific risks. In fact according to critics, complex risk management problems become “processes of consent management in the face of the unknowable” (Power, 2004:55). Nowadays, construction projects are public-private consortia’s in which numerous parties play an important role. Van Staveren (200:12) claims that in the design and construction of Terminal 2E of the Roissy-Charles de Gaulle Airport in Paris over 400 different construction and engineering parties from across Europe were involved.
- Construction value chains have also increased in length as new technologies and new innovations were incorporated in large-scale infrastructures. Along with the increased interdependence that was just explained, we could also argue that exactly this interdependence not only increases the possibilities for more well-known risks to occur, but also increases the subjective assessment of others in the entire process. Here the problems of rationality and the risk handling of risk takers plays a role. As a consequence of strategic behavior, risks and insecurities are shifted and externalized, the relative scope and impact of these risks and insecurities raises even further.
- The previous consideration is strengthened by the fact that risks are (highly) dynamic, meaning that risks and interdependencies shift as contextual situations in which large-

scale infrastructure projects are constructed change. Increasingly, new priorities are set in projects as a result of the increased complexity of society (Powers, 2004:38). Between the risk analysis performed during the project reconnaissance phase and the project-realization phase many things can change. However, many infrastructure projects are based on the assumption that there is a large technological risk component and that contextual factors have little influence on the project. Instead of more traditional and quantifiable risks that are involved with the technical aspects of the project design, we can identify an increasingly larger set off dynamic risks and uncertainties emerging in these contextual environments. More dynamic and complex and interactive risks and less quantifiable uncertainties resulting from, for example more complex contracting arrangements (such head contractors, sub-contractors, public-private contracts) have increased.

- The time and opportunity to perform an in-depth analysis to analyze risks and safety boundaries through classical risk management procedures have been reduced as well. The political environment in which large infrastructure projects are embedded has increased the speed with which infrastructure project management decisions have to be taken. Instead of taking time to explore these risks and uncertainties, these risks remain uncovered and are 'traded off' for speed as management decisions are more determined by management targets (such as within time) than probability-estimates (Williams, 1995:25). Risks are distributed, and re-emerge in this phase at the start of these projects. During this vital contracting phase, where the outline for the conduct of the project is laid down, these risks become increasingly invisible.
- One of the most fundamental problems nowadays is that many parties involved in the supply chain of large scale construction projects have a very low acceptance level of risk. This means that some actors are unwilling to absorb risks, whereas others are willing to take on excessive risks, resulting in fundamentally unbalanced distribution of risk. The end result is often such that actors no longer are aware of the risks they are taking, or are forced to take on risks they should never have taken on, creating more vulnerable, rather than more robust systems. Furthermore, large-scale projects are often only made possible after a long and intensive phase in which risks and rewards are traded-off against each other in complex and carefully balanced proposals where risks and costs are painstakingly distributed. Any alterations may lead to a severe crisis in the management of this type of project.

- Finally, another shift in the make-up of actors in large-scale infrastructure projects may be noticed. As a result of the increased institutional fragmentation, reduced oversight and deregulation the relative power balance that existed between actors that argue for large and daring infrastructure projects and those that might oppose them has shifted. This means that the ratio of risk-averse actors (e.g. local inhabitants, oversight bodies, public opinion) versus that of risk seeking actors (e.g politicans, that want to realize the projects, project lobbyists that want to realize the projects, consultants who have no responsibility to the project whatsoever, and infrastructure constructors that are looking for work) has shifted as well.

In the list, a number of common denominators can be identified - dimensions underlying these observations. Instead of the 'traditional' approach towards risks in large scale infrastructure projects in which specific risks are singled out, a more holistic and systemic approach is needed that not only deals with identified and generally accepted risks, but also identifies and deals with more vague and ambiguous risks and uncertainties. This means that risks have to be perceived and shared; ambiguity is part of the problem which requires a risk communication and joint image building. Since fragmentation and opportunistic behaviour is induced by governance structures and new ways of doing things, risks evolve from a governance problem in large projects. Given these 'trends and developments', it could be argued that new ways of dealing with risks and uncertainty in large scale infrastructure projects should be considered (cf. Atkinson et al., 2006, Ward and Chapman, 2003).

In search of solutions

Considering that the abovementioned list of problems is incomplete and the highly diverse make-up of issues on this list, it could be concluded that the complexities of the challenges that face modern day public infrastructure projects are daunting. (cf. Van Staveren, 2006:20). The consequence must be that ways in which systems have been dealing with risks needs to be changed. Solutions have been suggested to overcome these problems.

For example,Van Staveren (2006:20) identifies a plea to change the risk averse attitude in the construction industry into a more risk seeking attitude. This requires the cooperation between different parties and should cause a change in the behaviour of actors in the construction industry from risk allocation to risk sharing. To reach this level of communication, interaction

between actors involved in large-scale infrastructure projects is needed to enable them to reach a joint perception of the risks and uncertainties involved in the project.
Projects in which actors work together in search of common risks may be able to lower the possibilities of unknown and perverted risks. This would result in joint risk analysis and comminication to reduce ambiguity; which requires process management and collaboration. The ideas build on ideas of partnering. However, this attitude has proven far more difficult to introduce and realized than expected. The caveat is that these types of collaborative projects do not succeed in an anonymous environment (where actors will strive to achieve their own goals rationally) but need to be embedded within a more transparent environment. This requires a new way of thinking and a new way of organizing large scale infrastructure projects. Overcoming opportunistic behavior, due to fragmentation in contracting and other governance issues dominate this line of thinking.
Governance attitudes towards risk taking are reconsidered in light of the behaviour that is displayed in large scale infrastructure construction projects. Use of the precautionary principle, strict regulation and the application of larger margins and buffers stimulates actors to take a risk averse approach, individually assess risks and uncertainties and externalize risks to the largest possible extent which suffocates innovation and quality, neglects compensation behavior and eventually reduces chances for large projects to be realized at all.
Another string of solutions focuses on existing risk management tools and focuses on an improved implementation of risk management tools: increased awareness among actors in large infrastructure construction projects being one of the most important issues (cf. Van Staveren, 2006). However, the approach becomes increasingly problematic in large-scale multi-actor environments and assumes a ‘rational’ and top-down approach towards the way in which risks and uncertainties can be identified and dealt with.
As part of a broader strategy of dealing with risks and uncertainties, some have claimed a shift from a predict and control towards a more realistic prepare and commit approach to risks and uncertainties. In allowing for broader overview of potential project uncertainties, possibilities for constructors, operators and users to deal with unexpected events and ‘black swans’ should be possible. The ideas build on ideas of a learning organization, High-Reliability theory etc. However, in doing so, much focus and efficiency is lost.
Again others have identified the need of a system approach in which experts with substantive expertise and knowledge (not managers) clarify the safety boundaries of the system (substantive systems versus managerial approach).

Finally, there are those that have forwarded the contingent approach, claiming that the form of regulation needed to enable and force actors in large-scale construction projects to adequately identify, asess and respond to risks and uncertainties depends on the context: Piling up process approaches likethe ones suggested in an innovative infrastructure project which is not regulated by existing frameworks is problematic.

Conclusions

This track aims to address challenges in risk management and identify potential solutions to mitigate these problems. We do not have to choose amongst these ways of dealing with the increased complexity of large-scale infrastructure construction projects. Each of these solutions has its own strengths and weaknesses.We simply identify them as possible courses of action or senario's to deal with the crisis identified in the process of developing large-scale construction projects. The track will therefore explore questions like:

- What are the limits of current risk management approaches in infrastructure management;
- What cases and experiences can be identified in the management of infrastructures where the perverting effects of the current risk management stratagems occured;
- What alternatives to current employed management stratagems exist (for example, does the fact that market-based risk management strategies failed in infrastructure management mean a reversal to more government-based risk management strategies?)
- What transitions in approaches to the risk management of infrastructure can be identified. How realistic would this be? What alternatives are left?

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