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### Navigating mega projects through complexity and uncertainty: strategic and adaptive capacity in planning and decision-making

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## Prologue

Around the turn of the millennium, academia began to take a strong interest in mega projects. More and more, large projects, especially large transport projects, appeared to be very expensive failures. Decision-makers, planners and project managers seemed to be unable to meet forecasts or to develop a project within time or budget. Most prominent in the debate about projects not delivering on their promises are Flyvbjerg cum suis (Flyvbjerg, 2006; 2008; Flyvbjerg et al., 2003; Flyvbjerg et al., 2005). Also the edited book of Priemus et al. (Priemus et al. 2008) is a prominent and broad analysis on mega transport projects. Examples of research focusing on more general mega projects (Altshuler & Luberoff, 2003; Majoor, 2008; Salet & Gualini, 2007) are also plentiful in this first decade. There is a strong tendency in especially the literature on transport projects to define success as delivery of a project on time, within budget and achieving the estimated patronage. Factors identified as leading to cost and time overruns are strategic misrepresentation and optimism bias (Flyvbjerg, 2008), scope creep (Shane et al., 2009), political and engineering desires for the sublime technology and design (Van Marrewijk et al., 2008; Trapenberg-Trip, 2008), and poor project management (Koppenjan et al., 2010). For a good overview of the literature see Cantarelli (2011).

Within this dissertation however, I have been particularly interested in how the decision-making and planning processes respond to issues of uncertainty and complexity. Part 1 of the book introduces the dilemmas and ideas that form the departure point for this research. It observes that uncertainty and complexity are often dealt with by closing or narrowly framing the planning and decision-making process and argues that an adequate learning environment and the generation and reduction of variance are key to dealing with uncertainty and complexity. Part 2 explores these basic hypotheses further and focuses particularly on adaptive capacity, which concerns itself with how the decision-making and planning process of mega projects responds to change, and strategic capacity, which discusses how to organize the process in order to be more adaptive. These concepts are explored using empirical work on two mega projects in the Netherlands: the HSL-Zuid, a high-speed rail connection, and RandstadRail, an interregional light-rail network. In addition, a third project called the Beneluxlijn, a metro extension to the Rotterdam metro network, is explored because it was particularly successful in managing cost and time. This last chapter looks at the different advantages and disadvantages of the 'keep it simple' approach chosen for this particular project. Part 3 concludes the dissertation by bringing together the developed theoretical concepts and the empirical data together.

This research is part of a broader research project. In response to the increasing interest in mega project planning, the Volvo Research and Education Fund financed the research center OMEGA to organize international research into the planning and appraisal of mega urban transport projects. The University of Amsterdam is one of the ten partners and this dissertation is the result of an analysis of the data gathered by the author for the project. The influence of the center is especially noticeable in the research design and explains some of the redundancy in the data compared to what is used in this work. The following section introduces the research design.

## Research Design

In this section I introduce the research design of the dissertation and how it was conceived and evolved. The main research question driving this dissertation is: what makes the decision-making and planning processes of mega projects more, or perhaps less responsive to issues of complexity and uncertainty. Case study research is an approach that is especially suited for understanding driving mechanisms (Gerring, 2007; Yin, 2003). Quantitative analyses, as commonly done in housing studies (Gent et al., 2009), demography (Smits, 2010) or political science (Van Der Brug & Van Spanje, 2009), often make use of existing datasets to test developed hypothesis and theories. The datasets are generally not specifically developed for the research, but measured variables are adjusted or used as a proxy to analyze the desired conceptual framework. The same data is seen and modified through different lenses depending on the interest of the researcher.

The aim of the data gathering strategy in this research is to approximate this type of dataset yet with qualitative data. I call this strategy a narrative/reflexive approach and it makes use of two types of interviews undertaken with the same respondents. Narrative interviews are the primary sources for data about the processes and events in the researched cases. This type of interview focuses on stories that subjects tell, on their recounts of past events. The interviewees are prompted to reconstruct the process without being pushed into a hypothesis driven direction: "After the initial request for a story, the main role of the narrative interviewer is to remain a listener, abstaining from interruptions, occasionally posing questions for clarification, and assisting the interviewee in continuing to tell his or her story." (Kvale & Brinkmann, 2009: 155). The data derived this way is extremely useful to link or develop conceptual ideas on the basis of empirical data. The following prompting questions are examples of the type of questions asked:

*-What were the crucial moments in the decision-making and planning process?*

*-What were the moments of breakthrough or stagnation?*

This type of enquiry is very suitable for reconstructing the general decision-making process and to discover what the driving forces behind crucial moments were. And because the same questions are posed to all interviewees, they can be contrasted with each other and a saturation point can be identified in which additional interviews do not add new information to the data.

The second type of interview is driven by hypotheses. This type of interview offers the possibility to have respondents reflect on certain subjects and hypotheses. At the first design of this dissertation, the idea was to base these hypothesis driven questions on hypotheses developed from a grounded theory analysis (Glaser & Straus, 1967; LaRossa, 2005) on the narrative data and thus enabling the researcher to test his or her developed ideas in practice. This would fulfill a complete analytical cycle of theory development and theory testing, both grounded in empirical work. However, because the research was part of a larger international project, the cross-country comparative requirements forced the project group to use pre-determined hypotheses. Thus in this research, questions are included about risk, uncertainty and complexity, decision-making, success factors, and sustainability issues.

The resulting dataset including narrative and reflexive questions can be analyzed using a combination of deduction and induction and the structured nature also makes it possible to analyze on a case as well as aggregate level. In this dissertation it proved most useful to keep the analysis on a case study level. Thus the narrative/reflexive approach offers data for a wide range of analytical and theoretical approaches. However, case selection remains an issue. Because the approach is both explorative and hypothesis testing, the most obvious case selection would be typical or diverse. Ideally, one would want a case or cases that represent a larger population of cases in order to be able to make generalizations. And because this approach wants to create a dataset to which different analytical perspectives can be applied, there should be a general premise behind the case selection that is not driven by particular hypotheses. In this research, the cases were selected in a two-fold manner. From an international comparative perspective, certain criteria were given for the case selection. The projects had to be land based transport infrastructure of above 500 million dollars (1990 prices) with an urban impact. The project had to be commenced after 1990 and had to be finished before the interviews took place. This of course limited the options in a small country such as the Netherlands. After a scan of potential projects, the decision was made to focus on rail projects with different institutional arrangements. The cases were an (inter)national project (HSL Zuid), an

interregional light-rail project (RandstadRail) and a local light rail project (Beneluxlijn). The projects were also diverse in cost and time overruns, as the HSL experienced large overruns, RandstadRail was around its evolved targets and the Beneluxlijn was delivered approximately on time and safely within its initial financial budget. As this research is aimed to develop and explore hypotheses, the variation was crucial. And although it might be difficult to generalize over all mega projects, because they are so dependent on context, the found patterns in decision-making and planning found in this research are likely to be of interest to a wider field than that concerning mega transport projects.

## Outline of the book

This dissertation starts with an explorative study into the role of complexity and uncertainty in the planning and decision-making of mega infrastructure projects. Chapter 1 identifies several pathways that point in a different direction than the tendency in current policy to look for simplification of the decision-making process. It expresses the need to create a process of learning, to generate and reduce variety, to cherish an ambiguity in framing the mission strategy, and to give space to the tensions between different interests.

Chapter 2 focuses on the type of adaptations made in mega projects and the mechanisms behind them. It looks at the adaptive capacity in decision-making on mega projects. Because of the narrow framing of the project early on in the process, the possibility to adapt to new insights, contextual changes and new opportunities is limited. To assess the adaptive capacity present in the process, a typology of adaptations is developed from organizational learning theory. The assumption is that adapting and learning are strongly related to each other. The analysis is conducted on the empirical data from the HSL and RandstadRail cases.

Chapter 3 continues with the challenge of designing a process in which there is a higher strategic capacity, or a way to add more value to a project. The focus is on approaches to deal with issues such as strategic ambiguity, redundancy and resilience. The developed concepts are applied to the cases of the HSL-Zuid and RandstadRail. In order to respond adequately to uncertainty and complexity while remaining open for potential adaptations that add value, a continuous recombination of ambitions, interests, actors and knowledge is necessary. Using this strategy, a mega project is not only resilient in a reactive way, responding to opposition by inertia or incremental adaptations, but also is proactively resilient, ready to learn and adapt when necessary or when there is opportunity for improvement.

Chapter 4 analyzes the Beneluxlijn case. What is it that has made the project so successful in keeping time and cost within budget? It seems that the decision-makers, planners and project managers were all very adept at making the process and project as simple as possible and as a result of that and particular financial incentives the project was managed very tightly. The project seems to support general theory on cost and time overruns. However, keeping it simple does come at a cost and it is dependent on the type of project whether this strategy is possible and the role it plays within a broader spatial strategy.

Chapter 5 is the concluding chapter of this dissertation and it explores more in depth the relation between adaptive and strategic capacity. What does it mean for the adaptive capacity when the strategic capacity is organized in a particular way? Or vice versa, if we want to open a project to potential radical adaptations, how do we organize the strategic capacity in order to make it possible? This chapter brings together all the theoretical concepts developed in the book and discusses them for all three cases. And by bringing all the results together, this chapter is the final fitting stone that closes the challenging construction of this dissertation, which hopefully proves a worthy read.

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