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This paper asks why uncertainties are avoided in dominant megaproject practice while planning scholars are increasingly advocating adaptive planning and uncertainty acknowledgement. We propose a novel analytical framework to explain uncertainty avoidance, consisting of two current explanations – resource constraint and strategic behaviour models – and a complementary institutional model. We apply the framework to a seaport megaproject in Flanders to test its validity. Results show that the institutional model increases our understanding of uncertainty avoidance. More attention to planning institutions and far-reaching institutional changes are required to facilitate a move towards uncertainty acknowledgement and adaptive planning.

Keywords: megaprojects, uncertainty, adaptive planning, institutional analysis

Introduction

Large urban and infrastructure projects, or 'megaprojects', involve complex planning processes. They are large-scale, require high investments, have a long-term horizon, involve and affect many stakeholders, and have a major impact on society (Flyvbjerg, 2014). Complexity and uncertainty about the future are inherent and irreducible features of megaprojects (Bertolini, 2010; Salet et al., 2013). Successful megaproject realization is therefore difficult, and poor performance is commonplace. Megaproject literature has increasingly shown that cost overruns, time delays, poor results, or adverse impacts occur frequently (e.g. Cantarelli et al., 2012; Flyvbjerg et al., 2002; Welde & Odeck, 2017). Various causes for poor megaproject performance have been identified (De Jong et al., 2013; Denicol et al., 2020; Flyvbjerg et al., 2018). Two interrelated causes are inherent complexity and the need to make decisions and act under conditions of uncertainty (Sanderson, 2012).

Uncertainty does not cause project failure, but poor assessment and avoidance of uncertainties do. Through the rational 'planning and control' approach (Skrimizea et al., 2019), also called 'predict and control' (Koppenjan et al., 2011), practitioners try to simplify reality by denying the existence of complexity and uncertainty. Decision making is supported by supposedly accurate analyses of costs, benefits, and effects, but these have limitations in dealing with unforeseen developments (Rauws, 2017). While remaining dominant in planning and megaproject practice, 'predict and control' has lost its relevance in the contemporary planning context, which is characterized by uncertainty and complexity (Bergsma et al., 2019). As a response, planning and megaproject scholars are increasingly advocating a move towards uncertainty acknowledgement and adaptive planning that is more responsive to unexpected changes (Giezen, 2013; Salet et al., 2013; Skrimizea et al., 2019). Despite this growing consensus for integrating adaptivity in planning to better cope with uncertainties, in practice, 'predict and control' persists as the dominant approach (Bosch-Rekveldt et al., 2011; Giezen et al., 2015; Lehtonen et al., 2017).

To encourage the adoption of adaptive planning, we need to understand why uncertainty avoidance remains commonplace. Project failure has been researched extensively, but less research has tried to explain why megaproject practice still aims for certainty about the future, which De Roo (2018) has rightly called an illusion. To address the research gap, this paper considers what factors explain uncertainty avoidance in planning and decision making for complex planning issues, such as megaprojects, and what these explanations add to the concept of adaptive planning. To answer these questions, we consider bounded rationality (resource constraints) and strategic behaviour (manipulation and optimism bias) as models that explain uncertainty avoidance. Both concepts are well-researched explanations for poor megaproject

performance. We show that although the resource constraint and strategic behaviour models do provide some clarification, these models are insufficient to explain uncertainty avoidance. Based on new institutionalism (NI), we propose the institutional model to explain uncertainty avoidance. Together, these three models form a novel analytical framework to understand uncertainty avoidance. To test and illustrate its merits, we apply the framework – using document analysis and interviews – to a case study of an ongoing seaport megaproject in Flanders.

The remainder of this paper is organized as follows. We first explore the growing trend of uncertainty research in megaproject and planning literature. Next, we present our analytical framework and the three theoretical models. We then apply this framework to our case study. Finally, we discuss the merits of the different theoretical approaches for explaining uncertainty avoidance and what they add to the concept of adaptive planning.

Megaprojects and uncertainties

Uncertainty and adaptive planning are well-researched topics in planning literature and megaproject literature. From the late 1960s onwards, planning scholars have recognized the challenge of coping with uncertainty in planning. Friend and Hickling (1987) distinguish three uncertainty types in public planning: uncertainty in the environment, in related decision areas, and in value systems. Their strategic choice approach is an early advocate of uncertainty acknowledgement and flexibility, allowing decision makers to better respond to unexpected circumstances (Friend & Hickling, 1987; Friend & Jessop, 1969). Another influential example is Christensen's (1985) distinction between four planning problem conditions, based on (un)certainty over means and ends. Christensen

argues that planners should address uncertainty, not ignore it: “if uncertainty is the source of planners’ problems, it can also be the path to those problems’ solutions” (Christensen, 1985, p. 71). More recent planning contributions that conceptualize uncertainty and propose adaptive planning are inspired by climate studies (Zandvoort et al., 2018) and complexity theory (Rauws, 2017; Skrimizea et al., 2019).

In project management literature, different uncertainty types have been distinguished by various scholars. Bertolini and Salet (2008) identify four sources of complexity and uncertainty in megaprojects: the dynamic and multiple possible interpretations of megaprojects, political and social conditions, legal and financial conditions, and technical conditions. A similar distinction between sources of uncertainty is presented by Priemus (2010), Priemus et al. (2013), and Machiels et al. (2020, 2021). Other scholars approach uncertainty as a concept different from risk, arguing that these terms are often used interchangeably but should not be equated (Atkinson et al., 2006; Sanderson, 2012; Williams et al., 2019).

In harmony with planning literature, megaproject scholars argue that adaptive planning is the key to coping with uncertainty. Different options need to be kept open as long as possible to guarantee flexibility and allow adaptations (Bertolini, 2010; Priemus, 2010). Approaches that represent adaptive planning are the ‘prepare and commit’ perspective (Koppenjan et al., 2011), adaptive and strategic capacity (Giezen, 2013), and real options theory (Machiels et al., 2021).

While planning literature and megaproject literature increasingly stress the importance of adaptive planning, both assume that uncertainty acknowledgement is self-evident. We agree that uncertainty acknowledgement is a prerequisite for adaptive planning, but argue that uncertainty acknowledgement must be achieved by first

overcoming uncertainty avoidance. Therefore, an analytical theoretical framework to understand uncertainty avoidance is a valuable addition to this growing academic field.

A theoretical framework to explain uncertainty avoidance: three explanatory models

The resource constraint model

The first model that explains uncertainty avoidance in current planning practice is the resource constraint model. The origins of this model date to the 1950s, when Herbert Simon coined the term bounded rationality as a critique of the rational model (Simon, 1997). Rationality is limited because decisions are made under knowledge, time, and budget constraints (Simon, 1997). Decision makers show satisficing behaviour; they make decisions that are "satisfactory or good enough" in a context of imperfect knowledge (Simon, 1997, p. 119). We cannot know everything; thus rationalizing reality is impossible (Simon, 1997). Applying this principle to megaprojects, decision makers lack complete information and are uncertain about the future (van Marrewijk et al., 2008; Williams & Samset, 2010). The search for alternatives is limited by time, money, and cognitive capacity (Sanderson, 2012). Time pressure on politicians, who are required to make rapid decisions, and a lack of funding are examples of barriers to a detailed assessment of uncertainties. Friend and Hickling (1987) already noted this in the 1980s:

> In general, however, uncertainty can only be reduced at a cost – whether this be merely the cost of delay when there may be urgent issues to be settled, or whether it also includes more direct costs in terms of money, skills or other scarce resources. (p. 13)

The essence of the resource constraint model is that practitioners lack the means to

manage uncertainties adequately and therefore avoid them.

The strategic behaviour model

The second model is the strategic behaviour model, based on recent megaproject literature by Flyvbjerg and others, in which increasing quantitative evidence has shown the high frequency of forecast inaccuracy (e.g. Cantarelli et al., 2012; Flyvbjerg et al., 2002; Welde & Odeck, 2017). According to behavioural science, the root cause of project failure due to cost underestimation and benefit overestimation is human bias, either psychological or economic-political (Flyvbjerg et al., 2018). On the one hand, optimism bias – a psychological explanation – suggests that decision makers and forecasters fall victim to overconfidence by underestimating costs and overestimating benefits (Flyvbjerg et al., 2009). An overly optimistic scenario is created, in which known risks and uncertainties are circumvented (Denicol et al., 2020). On the other hand, strategic misrepresentation – an economic-political explanation – means forecasts are deliberately falsified to satisfy decision makers or politicians and obtain approval for a project proposal (Flyvbjerg et al., 2009). Beukers et al. (2012) suggest that cost–benefit analyses (CBA) occur too late in the process and are used only to justify decisions. Cardenas et al. (2016) indicate that uncertainties in environmental impact assessments (EIA) are often obscured to avoid controversy among stakeholders or to enable rapid approval. Deliberate falsification is not penalized because forecasters and decision makers are not accountable for inaccuracies (Flyvbjerg et al., 2002). Manipulation of forecasts usually happens by underestimating costs and ignoring risks (Denicol et al., 2020). The essence of the strategic behaviour model is that practitioners deliberately underestimate and ignore uncertainties and megaproject complexities for strategic reasons or because of overoptimism.

The institutional model

Recently, both planning and megaproject literature have argued that increased attention to the institutional contexts in which planning practices are embedded is required, from the viewpoint of an institutional analysis (Biesenthal et al., 2018; Salet, 2018). New institutionalism has not yet been used to its full potential in planning theory and practice (Sorensen, 2017). It is the basis for the institutional model that we propose.

New institutionalism consists of three main branches: rational choice institutionalism, sociological institutionalism, and historical institutionalism. Excellent overviews are provided by Hall and Taylor (1996) and Sorenson (2017). At the core of NI is the analytic distinction between formal and informal institutions (Sorensen, 2017; Taylor, 2013), described by North (1990) as "the rules of the game" (p. 5). Every branch of NI defines institutions as sets of rules (formal) and shared understandings (informal) that shape actions (Sorensen, 2017). Megaproject planning and decision making are deeply embedded in formal and informal institutions. Formal institutions, for instance, include juridical procedures and legal instruments, such as EIAs, zoning plans, planning procedures, and expropriation procedures. Informal institutions include shared norms, conventions, ideas, routines, and customary practices. Project managers of megaprojects use scripts of project management approaches (such as phase models) and rule-of-thumb approaches that have evolved in their field.

The three branches of NI explain institutional change and how institutions shape action, create order, and provide structure in everyday life (North, 1990; Sorensen, 2017). Planning institutions create institutional stability so that decision makers, planners, and project managers know the rules of the game, which determine the criteria for legitimate decision making. The integration of uncertainties in decision-making processes in megaproject planning itself creates an uncertainty, or a meta-uncertainty:

for example, decision makers must decide what kinds of uncertainties are relevant and how to manage uncertainties so that their decisions are accepted as legitimate. In such a context of meta-uncertainties, NI argues that decision makers and project managers rely on prescriptions from vested norms and procedures. These constitute accepted, legitimate approaches to making decisions and either avoiding or managing uncertainties. The essence of the institutional model is that the institutional context of planning prescribes uncertainty avoidance. Hence, uncertainty is avoided, and the 'predict and control' approach is maintained. Table 1 summarizes the three theoretical approaches in one analytical framework.

Table 1. Analytical framework: theoretical models to explain uncertainty avoidance

Research methods

The New Lock Zeebrugge seaport megaproject involves the construction of a large sea lock in Flanders' second most important port. The ongoing project has passed the initiation and planning phases. At the planning level, the Flemish government has officially decided the location of the new lock. The current phase, at the project level, consists of designing the lock for the selected location. Because uncertainty is at its highest during the early stages of a project (Samset & Volden, 2016; Williams et al., 2019), we researched uncertainty avoidance during the planning phase of the case.

Single case study: the New Lock Zeebrugge

The port of Zeebrugge is in the province of West Flanders, near the North Sea. The town of Zeebrugge (part of the city of Bruges) is located within the boundaries of the port and consists of three neighbourhoods – Zeebrugge Dorp, Stationswijk, and

Strandwijk – inhabited by about 4300 people. Figure 1 provides an overview of the port and town structure. The smaller Visart lock, constructed in 1907, is outdated and too small for modern shipping. All major traffic to the rear port moves through the Vandamme lock, which opened in 1985 and is increasingly showing signs of decay and malfunction. If the Vandamme lock malfunctions for a long period, the rear port becomes inaccessible to incoming traffic, and outgoing traffic cannot leave. To avoid the risk of an economic shutdown, there has been agreement since the early 2000s that a second modern lock is needed. Despite a great deal of research and planning, no significant progress was made until 2016 due to opposition and legal action by local citizens and some fishing and port companies.

Figure 1. Zeebrugge town and port and location alternatives for the new lock

The project was restarted in 2016 with the Flemish decree of complex projects, a new procedure for complex planning projects with an emphasis on transparency, openness, broad stakeholder involvement, and accelerated realization. This procedure guides projects through four phases: an initiation or exploration phase, a research or planning phase, a project or design phase, and an implementation phase. We limited our analysis to the planning phase (Figure 2), during which six location alternatives for a new lock and a regional road, NX, to separate heavy port traffic and local town traffic were compared (Figure 1). Research was completed at the end of 2017 and consisted of a social CBA (SCBA) to compare the monetary costs and benefits of each alternative, an EIA to compare the environmental impacts, and maritime research to compare safety and nautical accessibility. These are institutionalized instruments in Flanders and mandatory steps in the planning phase, each with guidelines and procedures. Based on the reports, the Flemish Minister of Mobility and Public Works decided in March 2018

on alternative 2, Visart, which has an estimated cost of 1.09 billion euros and an expected construction time of six years. Visart involves the construction of a new lock at the location of the old Visart lock, with the NX as a tunnel under the new lock.

Figure 2. New Lock Zeebrugge, overview of the planning phase

This decision came as a surprise because Visart scored lowest in the maritime research. It provoked opposition from dissatisfied citizens, the impacted marina, local politicians, and some port companies. Opponents fear this new lock, which is between two neighbourhoods, will have a large negative spatial and environmental impact on the town's liveability. The Verbindingsdok Alternative was preferred by the City of Bruges, local citizens, and others for its remote location. Verbindingsdok was more expensive (1.46 billion euros) and had a 12-year construction period.

Despite many questions and concerns raised during the subsequent consultations with government institutions and a public inquiry, the decision for Visart was made official in May 2019. The Flemish Minister for Mobility and Public Works argued that Visart was chosen for its reasonable price and implementation time compared with other alternatives. An action plan was promised in the final decision-making document, including nautical optimizations and measures to safeguard the liveability and spatial quality of the town's neighbourhoods. While the project phase has been initiated, legal complaints are requesting annulment of the official decision. The verdict is expected in early 2021. A verdict in favour of the opponents could mean the planning phase has to be (partly) repeated, causing a delay of at least two years.

Document analysis and interviews

To analyse how uncertainties are reported and whether our theoretical models explain

uncertainty avoidance in a real-life case study, we combined a document analysis with semi-structured interviews. These information sources are complementary. Documents provide an understanding of the project's content, while interviews help to reconstruct the 'behind-the-scenes' processes of planning and decision making. Such an approach, along with developing a theoretical framework and applying it to an in-depth single case study, has delivered valuable insights in comparable studies (Giezen, 2013; Koppenjan et al., 2011).

The document analysis consisted of regulatory documents, project documents, and press articles. Regulatory documents are legislation and procedures that apply to all projects in Flanders, such as EIA legislation and guidelines, and the Decree of Complex Projects. Project documents are the case's mandatory documents arising from regulation and procedures. These include the planning phase's research reports (e.g. EIA, SCBA), governmental decision-making documents, summaries of advice from consultations and the public inquiry, and documents with general project information. Fourteen project documents were subjected to a content and discourse analysis. The content analysis considered what is written about uncertainties in the documents, while the discourse analysis considered argument patterns (Hijmans, 1996). Additional press articles were used to better understand the case. This approach permitted us to illustrate to what extent project elements were officially identified, researched, and communicated as uncertainties and whether uncertainties influenced decision making. A comparison could then be made with concerns and questions raised during the public inquiry and consultations. This made it possible to assess whether questions and concerns that can be regarded as uncertainties were recognized or avoided in the policy evaluation and decision making. We interpreted project elements as uncertainties if their future states were unknown; they thus had an uncertain effect on the expected timing, costs, impacts,

and benefits of the project. All project documents used in the analysis are available on the project's website.[1]

Additionally, 16 interviews were conducted between September 2019 and March 2020 with 25 people, who represent 15 internal and external project stakeholders or organizations. Internal stakeholders are either part of the project team or involved in the decision making: for example, the project leader, the Port of Zeebrugge, and the Ministry of Mobility and Public Works. External stakeholders are either directly or indirectly impacted by the project: for example, the fishing companies, the marina, and the town's citizen action committee. During the interviews, respondents were asked to describe the planning phase and decision-making process from their perspective, with emphasis on which uncertainties had (not) been identified and addressed, how uncertainties were treated, which uncertainties were important to them, and why they believed specific uncertainties were (not) addressed.

Interviews were recorded, transcribed, and analysed in NVivo, a software program for coding and analysing qualitative data. We created an initial list of codes based on the document analysis results and our theoretical framework, which was extended inductively by creating new codes while coding and reading the transcripts. The final codes revolved around three main topics: the three theoretical approaches to explaining uncertainty avoidance; the process of identifying, assessing, and communicating about uncertainties within the case; and specific uncertainties perceived by the interview respondents. By analysing the respondents' stories this way, we determined how stakeholders framed their understandings of uncertainty avoidance, which allowed us to assess the relative merits of the three explanatory models. The interview respondents were not aware of the theoretical framework while being

interviewed, which strengthens the empirical evidence (Bosch-Rekveldt et al., 2011; Yin, 2018).

Results: uncertainties and uncertainty avoidance in the New Lock Zeebrugge megaproject

Which uncertainties did stakeholders identify?

We identified uncertainties as perceived by project stakeholders in two steps. First, the reports of the consultations and public inquiry were analysed to identify questions and concerns that can be interpreted as uncertainties. These reports document each piece of advice (from consultation rounds) and complaint or comment (from the public inquiry) that was officially submitted. Second, we asked stakeholders during the interviews which uncertainties they perceived as important for the project. Concerns or questions that arose during the interviews were also considered uncertainties.

Overall, similar uncertainties were identified from both sources. Table 2 provides an overview and brief explanation of the most important uncertainties. We interpreted these project elements as uncertainties because, at the end of the planning phase, their future states and effects on the timing, costs, benefits, and impacts of the project were unknown. Many of these uncertainties are specifically related to Visart, the alternative chosen by the Flemish Government. For example, local citizens, the marina, and the fishing companies expressed concerns about the direct spatial and environmental impact of the new lock, due to its location. A different decision would have generated other perceived uncertainties.

The overview of uncertainties in Table 2 is not an exhaustive inventory of uncertainties but only the known unknowns as perceived by stakeholders. None of the interview respondents were concerned with, for instance, traffic forecasting

inaccuracies. This is surprising since seaport traffic evolutions are dependent on various uncertain factors outside the control of a single port, such as the evolution of the global demand for shipping, technological change in shipping and related sectors, and the future position of seaports in European and global shipping networks. Internal stakeholders and project proponents acknowledged the possibility of forecasting inaccuracies but did not consider the uncertainty important. In their opinion, the second lock is an infrastructural requirement to ensure the accessibility of the rear port, regardless of evolutions in demand. Local stakeholders were only concerned about uncertainties related to the chosen alternative that directly impacted them. If uncertainties are not proactively identified, many uncertainties and their impact are neglected and remain unknown unknowns. Identifying all uncertainties is difficult, but not trying at all increases the chance of 'black swans', unforeseen events with adverse consequences or missed opportunities for the project and its environment (Taleb, 2007; Winch & Maytorena, 2012).

Table 2. Project elements interpreted as uncertainties in project documents and interviews

Which uncertainties were part of the research reports and decision making?

Despite the variety of perceived uncertainties, only a limited number received attention in the decision-making process. Policy evaluation in this case strongly relied on 'predict and control'. Forecasts were either exact values or estimates of a single future and few uncertainties were documented, implying that there were barely any uncertainties.

Social cost-benefit analysis guidelines for infrastructure projects in Flanders seem to play a decisive role in the way uncertainties are managed. These guidelines were written in 2013 by a consultancy company commissioned by the Flemish

government. The guidelines contain standardized methods and quantitative assumptions that apply to all infrastructure projects in Flanders, distinguishing only between general types of projects (e.g. airport or seaport). Regarding uncertainties, the guidelines prescribe a sensitivity analysis alone, which was applied in the Zeebrugge case with a 25% increase and decrease in the total estimated costs for all six location alternatives. This sensitivity analysis is simple and brief. It does not identify or analyse in depth which project elements are uncertain and could contribute to a project cost increase or decrease. The choice of a 25% variation is not explained and appears arbitrary. Furthermore, sensitivity analyses following SCBA guidelines are applied in the same way to every infrastructure project and do not distinguish between projects or specific uncertainties.

Environmental impact assessment guidelines in Flanders derive from EU legislation that since 1985 has required member states to conduct an EIA for projects that could have negative environmental impacts. Regulations in Flanders were established with the 1995 decree on environmental policy. The EU and Flemish EIA legislation have both since been revised multiple times. The general guidelines for Flemish EIA practice were last revised in 2015 and prescribe a mandatory chapter entitled ‘knowledge gaps’, in which all uncertainties must be described. The chapter in the project’s EIA details one knowledge gap, described on one page of the 350-page report. This knowledge gap is an uncertainty regarding the potential impact of the Verbindingsdok alternative on a neighbouring nature reserve, caused by possible changes in groundwater level and composition. The nature reserve is a special protection area under the EU’s Natura 2000 environmental legislation. To reduce the knowledge gap, additional groundwater modelling was required but not conducted. Consequently, a possible negative impact could not be excluded. Following EU Natura

2000 legislation, a worst-case scenario had to be applied. Internal project stakeholders argued that this alternative could not be permitted if a negative impact was possible. This uncertainty was one of the three arguments that caused the rejection of Verbindingsdok, alongside its higher price and longer implementation time.

Internal stakeholders stated during the interviews that uncertainties were identified ad hoc or not at all. Uncertainties arose during meetings, consultations, or public participation but were not identified proactively. If uncertainties arose, stakeholders stated, they were 'cleared out' through consultations and discussions or, if deemed necessary, through additional research. Open communication and discussions between internal stakeholders needed to result in a consensus about which assumption, parameter, or result would be used in the research reports. Removing uncertainties thus meant achieving an agreed certainty between the stakeholders rather than considering multiple scenarios or future states. Second, uncertainties deemed irrelevant for the planning level were transferred to the project phase. Most questions and concerns from stakeholders were acknowledged in the final decision-making document of May 2019 through an action plan. These project elements were not acknowledged as uncertainties but as solvable problems to be fixed during the project phase.

Why are uncertainties avoided in policy evaluation and decision making?

The results show a gap between the uncertainties perceived and those that were officially acknowledged in policy evaluation instruments and decision making. Applying our theoretical framework makes it possible to explain why uncertainties were largely avoided in this megaproject.

The resource constraint model partly explains why additional research was not conducted to reduce the Verbindingsdok knowledge gap. Lack of time was one

important reason, according to various respondents. To choose this alternative, additional time and money needed to be invested in 'clearing out' the knowledge gap. A fast decision was preferable because the project had already lasted for more than 15 years, and there was urgency created by the aging Vandamme lock. Additionally, local citizens were tired of research, and the city of Bruges wanted to move forwards, as they had been requesting a second lock for years. There simply was no time for further research.

However, the institutional model explains better why this alternative was not chosen. Even after additional research, the results would have remained uncertain because a groundwater model is an estimate based on uncertain parameters. The actual impact can only be known upon project realization. In cases of uncertainty, environmental legislation and the precautionary principle prescribe that if a negative impact is possible, the worst must be assumed and the alternative cannot be permitted. One interviewee stated, "If Verbindingsdok is chosen, with this knowledge gap, the decision is vulnerable to legal action". According to the deputy head of the Minister's Cabinet, this knowledge gap was the main reason why Verbindingsdok was rejected: "the environmental impacts were uncertain, and therefore the risk that it would not legally hold was too big". Even if there was time to conduct additional research, it would not have had an impact: the remaining uncertainty forced the decision maker to reject this alternative based on the institutional context of environmental legislation.

The strategic behaviour model partly explains why many perceived uncertainties were not acknowledged as such in policy evaluation and decision making. Several stakeholders, mainly external ones, described the decision-making process as a political one, in which a political decision was made for the alternative favoured by the Flemish Minister of Mobility and Public Works. The SCBA and EIA were believed to be

politically manipulated, aimed at achieving the results needed to justify the decision for Visart. The Flemish Fish Auction believed that "several things were underestimated and overestimated to get the results they wanted, and the dangers of the impact on the (direct) environment were underestimated". One interviewee implied that the decision makers deluded themselves about the project costs but made the decision based on that factor. The local action committee felt that the "studies were made to make Visart look good" and various elements were deliberately excluded from the cost estimations, such as the required nautical optimizations, the possible increased length of the NX tunnel, the actual number of displacements, and the liveability plan. In contrast, they believed that unnecessary assumptions were made to make Verbindingsdok more expensive than Visart. On a similar note, the Marina believed research had been conducted in such a way as to make "other alternatives as infeasible as possible". The City of Bruges questioned if the price comparison had been conducted correctly. Finally, even the Port's CEO doubted the neutrality of the research reports and indicated that several benefits were not considered within the Port's preferred Carcoke alternative because it would make the Carcoke alternative look too good.

The institutional model provides an additional explanation for why project elements with clearly uncertain outcomes were not acknowledged as uncertainties. Planning institutions prescribe an uncertainty-aversive approach, and hence uncertainties are avoided. Seven of the eight internal stakeholders highlighted that uncertainties or knowledge gaps are avoided at all costs in decision making and official documents to ensure decisions are legally incontestable, to withstand legal action, and to facilitate project approval. This requires settling everything, reaching an agreed certainty, so there is no room left for discussion. The project leader said that "most parts need to be cleared out, so that after the decision making they are incontestable if other

parties take legal action'. The EIA coordinator felt that while the chapter on knowledge gaps is mandatory and important, not much time is spent on it. Knowledge gaps need to be resolved before a decision can be made. If there are knowledge gaps left at the end of the next phase, this presents the opportunity for legal action. This explains why little is written about uncertainties. To have an incontestable decision, project documents and research reports need to have as few discussion points as possible, and therefore as few uncertainties as possible. If this is not the case, legal action is almost certain to follow.

Therefore, whether or not uncertainties are ignored as a consequence of manipulation or overoptimism, they cannot be acknowledged as uncertainties in official documents to ensure the legal stability of an official decision. Furthermore, while the possible role of strategic behaviour cannot be ignored, strategic manipulation cannot be proven in this case without evidence. For the most part, it was external stakeholders who presented critical viewpoints and opponents of Visart who suggested manipulation. Additionally, it seems unreasonable to believe that the decision maker in this case had the power to manipulate the large network of stakeholders involved.

The empirical results illustrate the value of each explanatory model and thus the analytical framework for explaining uncertainty avoidance. Alongside resource constraints and strategic behaviour, the institutional model offers an important additional explanation that complements the explanatory power of the first two models. Overall, the interviewees realized that certainty about the future does not exist, but they still applied the 'predict and control' approach by internally reaching an agreed certainty and hence avoiding uncertainty. The legal instability of a decision was understood to be positively correlated with uncertainty acknowledgement. Interpreting concerns as solvable problems allowed the project to proceed linearly along the projected path while avoiding uncertainties and thus legal instability. In general,

Flemish planning legislation and procedures do not enforce uncertainty acknowledgement or assessments and still rely on linear 'predict and control' processes. The institutional context penalizes uncertainty acknowledgement and makes it undesirable; it prescribes, routinizes, and legitimizes uncertainty avoidance in day-to-day planning practices.

Uncertainty acceptance and adaptive planning: the need for an institutional approach

The resource constraint model and strategic behaviour model have value in explaining uncertainty avoidance, but their theoretical approaches are limited in facilitating uncertainty acknowledgement and adaptive planning. Resource constraints have been important drivers in the development of Lindblom's (1959) incremental planning model, which nevertheless aims to avoid uncertainty by sticking to alternatives that only differ marginally from the base scenario rather than searching for radical alternatives with unknown impacts. In today's megaprojects, minor changes are made intuitively or ad hoc when problems occur, as illustrated by the 'solvable problems' in the Zeebrugge seaport case. Incremental changes alone do not encourage proactively identifying uncertainties and considering multiple possible future outcomes.

Strategic misrepresentation and optimism bias can be curbed by a system of governance mechanisms, such as external quality control, increased transparency, increased accountability, proper risk allocation in contractual agreements, and so on (Flyvbjerg et al., 2003; Flyvbjerg et al., 2009). While important for curbing strategic behaviour, these solutions to project failure have been criticized as they provide "little or no explanation of how performance may be improved by making decisions to address unforeseen events and circumstances when a megaproject is underway" (Denicol et al., 2020, p. 336). Mechanisms to curb strategic behaviour still rely on the assumptions that

the future is controllable and it is possible to calculate the probabilities of a future path (Sanderson, 2012). However, linear ex ante planning cannot control inherent complexity and irreducible uncertainties (Lehtonen et al., 2017; Sanderson, 2012). It does not deviate strongly enough from 'predict and control' to encourage a move towards adaptive planning.

The institutional analysis of megaprojects adds more to adaptive planning concepts than the previous models. A change in institutional prescriptions is required to deal with complexity and uncertainty in complex projects (Salet et al., 2013). If the framing of projects is kept narrow to reduce complexity and uncertainty, the institutional capacity for adaptive planning is also kept narrow (Giezen, 2013). Flexibility in megaprojects is constrained by regulatory frameworks (Denicol et al., 2020), as current institutions have limits in their ability to cope with uncertainty and complexity (Bertolini & Salet, 2008). Adaptive planning is not yet common because legal and institutional structures do not support it (Kato & Ahern, 2008). The adaptive capacity of planning is either fostered or constrained by a variety of conditions, including governmental rules, regulatory frameworks, and instruments (Rauws, 2017). Therefore, planning processes and institutions that enhance adaptivity should be favoured (Bertolini & Salet, 2008).

The Flemish institutional context restricts adaptive planning opportunities. Flemish Environmental impact assessment guidelines dictate that uncertainties need to be excluded as much as possible, because uncertainties undermine the validation of EIA results and the motivation for selecting alternatives. Uncertainties limit the use of EIAs as a tool to support 'good' decision making. These guidelines inform legal practice in litigation procedures, on which EIA technicians anticipate. Planning legislation forces the selection of one alternative at the end of the planning phase to ensure legal certainty,

while other promising alternatives that could be more cost-efficient but have an uncertain impact are eliminated. This early elimination of options significantly reduces the project's adaptive capacity and flexibility. The institutionalized suppression of uncertainty acknowledgement and adaptive planning accompanies day-to-day practices during which uncertainties are not proactively identified but addressed only when they arise, as mentioned during multiple interviews.

These examples illustrate the mismatch between the current institutional planning context and the increasingly complex societal context for which we plan. The former prescribes single future estimates and uncertainty avoidance, while the latter implies that the truth lies closer to such expressions as 'we are uncertain and should consider plausible future scenarios'. This mismatch cannot be overcome if more truthful expressions that acknowledge uncertainty are legally penalized and considered institutionally unstable, while illusions of certainty are approved and considered to provide institutionally stable decisions. The 'planning game' needs new 'rules'. A regulatory framework and instruments are required that institutionalize not only adaptive planning but also uncertainty acknowledgement. Additionally, we need to change not only our approach through formal institutions but also how we informally think about planning and uncertainty in routines, shared norms, and daily practices. Acknowledging and accepting uncertainties challenges the nature of planning itself (Skrimizea et al., 2019).

Far-reaching institutional change is required to enforce and routinize uncertainty acknowledgement and to facilitate adaptive planning. Questions such as 'which planning institutions can facilitate uncertainty acknowledgement and adaptive planning?' and 'how can institutional change be achieved?' should be the subject of further research. On the one hand, research must start with a critical, in-depth analysis

of current institutional contexts to understand how both formal and informal institutions discourage uncertainty acknowledgement and adaptive planning. On the other hand, such analyses can reveal the underused adaptive capacity of current institutions.

In addition, we need more empirical results describing good examples of adaptive planning practices in megaprojects from an intuitionalist viewpoint. Rauws et al. (2014), for example, develop an instrumental framework of design principles for flexible development plans, including incremental development strategies and loose rules. Future studies must research how such frameworks can be formally institutionalized. In contrast to changes in formal institutions, changes in day-to-day practices need to be initiated through a participatory approach. A wide variety of actors needs to be accustomed to uncertainty acknowledgement and adaptive planning through learning and experimentation. Bergsma et al. (2019), for example, illustrate how Dutch infrastructure planning organizations reconsidered their informal institutional practices concerning stakeholder involvement as a consequence of increasing complexity and uncertainty.

Planning scholars have only recently been adopting NI in planning, hoping to boost institutionalist analyses (Salet, 2018; Sorensen, 2017). For example, Sorensen's historical institutionalism (2015, 2018) and Healey's sociological institutionalism (2006, 2018) can help explain how uncertainty-averse behaviour and actions are institutionalized, why the 'predict and control' approach is so hard to change despite increasing criticism, and how institutional change can occur. For example, Sorenson (2018) states that "planners should (…) consider the implications of institutional and physical designs that constrain the adaptability of urban areas to changing conditions" (p. 35). Institutional innovation and design involve changing both habitual practices and formal structures and rules (Healey, 2018). The objective of institutional design, in this

case, is to make the institutional environment more hospitable to adaptive planning and to create more effective planning contexts (Beauregard, 2005; Taylor, 2013).

Overall, an institutionalist viewpoint is a valuable addition to existing theories for understanding megaproject decision making. This viewpoint is necessary to foster a move from uncertainty-aversion and 'predict and control' to uncertainty-acknowledgement and adaptive planning. Because we opted for an in-depth single-case study, it is not possible to generalize our results. The explanatory power of the institutional model strongly relates, in this paper, to the institutional planning context of Flanders. On the one hand, additional research on uncertainty avoidance in different contexts can allow comparative institutionalist analyses and further test the analytical framework presented in this paper. On the other hand, research into good practice in institutional contexts that facilitate adaptive planning can offer insights into the possible trajectories of institutional change. Nevertheless, the institutionalized instruments described here, such as the SCBA and EIA, and informed decision-making processes apply to similar projects in Flanders, making this a representative case for the region.

Conclusion

As Christensen (1985) notes, "Planners hate uncertainty as much as most other people do, and they spend their working lives trying to reduce it" (p. 63). Over three decades later, Christensen's impression still applies to megaproject planning, and her message to not ignore uncertainties has not been heeded in planning practice.

We have contributed, in this paper, to the growing field of adaptive planning and megaproject literature by developing an analytical framework to explain uncertainty avoidance in megaproject planning and decision making. Current planning and megaproject research stress the importance of uncertainty acceptance as a prerequisite

for adaptive planning but assumes uncertainty acknowledgement. Understanding uncertainty avoidance is a condition for uncertainty acknowledgement and adaptive planning. The empirical results from a seaport megaproject in Flanders show that uncertainty avoidance should be understood as an institutionalized practice, routinized in formal and informal planning institutions. Key concepts of NI can help better understand how planning institutions fix uncertainty-aversive behaviour. Future theory-oriented research should address how these institutions are maintained, and how institutional change, innovation, and design can contribute to improved uncertainty acknowledgement and adaptive planning.

We have contributed to planning practice by highlighting the possible limitations of institutional contexts through a Flemish case. Flanders' planning context is not suited to cope with uncertainties or to adopt an adaptive planning rationale. We do not believe that Flanders is an isolated case, given the geographically wide data on planning and megaproject failures and the international focus of scholars on uncertainty and adaptive planning. Practitioners should become more aware of the formal and informal institutions that determine how they behave in planning and decision-making processes. Such self-awareness is an important first step. It promotes change and innovation to form an institutional environment that creates more effective and adaptive planning contexts. Future practice-oriented research should focus on which institutions facilitate or discourage uncertainty acknowledgement and adaptive planning.

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