Technological Forecasting & Social Change xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Technological Forecasting & Social Change

journal homepage: www.elsevier.com/locate/techfore

What makes long-term investment decisions forward looking: A framework applied to the case of Amsterdam's new sea lock

W.D. Pot[a,*], A. Dewulf[a], G.R. Biesbroek[a], M.J. van der Vlist[b,c], C.J.A.M. Termeer[a]

[a] Wageningen University and Research, Public Administration and Policy Group, Hollandseweg 1, 6706 KN, P.O. box 47, Wageningen, The Netherlands
[b] Wageningen University and Research, Landscape Architecture Group, Droevendaalsesteeg 3, 6708 PB Wageningen, The Netherlands
[c] Rijkswaterstaat, Griffioenlaan 2, 3526 LA Utrecht, The Netherlands

ARTICLE INFO

Keywords:
Forward-looking decisions
Infrastructure investments
Future anticipation
Public sector
Scenario use

ABSTRACT

Long-term investments challenge decision makers to look into the far future. Existing future studies often build upon a rational idea of decision making that does not help to explain why decision makers anticipate the future. In addition, existing studies do not provide a clear definition of what is considered as "forward looking". This article proposes a framework that can be used to evaluate and explain for what reasons and based on what criteria decision makers take forward-looking investment decisions. We apply this framework to a specific decision-making case about a Dutch sea lock, making use of interviews (n = 16) and a content analysis of primary documents (n = 430). We find that not all investment decisions are necessarily forward looking. Secondly, we conclude from our case that decisions became forward looking because administrators used scenarios, visions, and flexible solutions to build support, avoid political risks and comply to formal rules. Scenario developers and urban planners could therefore involve administrators in early stages of the decision-making process to increase their awareness of the future towards which they are steering and provide them with alternative future paths. Furthermore, they could identify and use relevant institutional rules with forward-looking features to stimulate forward-looking decisions.

1. Introduction

A current challenge in the developed parts of the world is that an increasing number of water management structures are approaching their end-of-lifetime consequent to technical aging or changing functional demands (Díaz et al., 2016; Grigg, 2017; Hijdra et al., 2014; Van Vuren et al., 2015). This challenge of end-of-lifetime infrastructure puts long-term investment decisions on the agenda of many public sector organizations. The long infrastructure lifetime of up to 100 years may require decision makers to look into the far future to anticipate future challenges and to decide on technical solutions that can cope with deep uncertainty (Nair and Howlett, 2014). Various institutional barriers, including political myopia, can make it difficult for decision makers to take decisions that anticipate the future (Bonfiglioli and Gancia, 2013). Furthermore, decision makers are faced with large uncertainties when they need to invest in infrastructure that will remain for 100 years. Uncertainties can arise because new technical solutions will become available during the lifespan of an infrastructure, climate change will impact the effectiveness of infrastructure, and user demands may change severely.

A growing body of literature supports decision making under deep uncertainty by providing a range of scenario and decision support methods (see Haasnoot et al., 2013). Scenario planning and deep uncertainty approaches often assume a rational decision-making process in which a decision maker formulates long-term goals, explores as many alternatives as possible, weighs future consequences, and chooses the solution that can withstand long-term change (Kwakkel et al., 2010; Restemeyer et al., 2016; Wise et al., 2014). This dominant perspective of decision making as an orderly process is more prescriptive than descriptive, being more concerned with how alternative solutions and futures *should* be explored than with how specific solutions are chosen (Mintzberg et al., 1998, p. 3; Stone, 2002, p. 184). Such a perspective therefore does not help to elucidate the complex processes that cause decision makers to consider the future when deciding to invest in end-of-lifetime infrastructure. Furthermore, the literature does not provide a clear definition of a "forward-looking decision" or equates forward looking to the application of foresight and scenario methods (Havas and Weber, 2017; Iden et al., 2016). Without a clear definition of what constitutes a forward-looking decision, it is difficult to judge whether

* Corresponding author.
E-mail addresses: wieke.pot@wur.nl (W.D. Pot), art.dewulf@wur.nl (A. Dewulf), robbert.biesbroek@wur.nl (G.R. Biesbroek), maarten.vandervlist@wur.nl (M.J.v.d. Vlist).

https://doi.org/10.1016/j.techfore.2018.01.031
Received 4 June 2017; Received in revised form 23 January 2018; Accepted 24 January 2018

and how scenario methods influence public sector investment decisions (Rickards et al., 2014; Volkery and Ribeiro, 2009).

This article aims to evaluate and explain for what reasons and based on what criteria decision makers take forward-looking investment decisions. The main question that guides this paper is: What makes long-term investment decisions forward looking? In answering this question, we aim to make two theoretical contributions. First, we develop a decision-making framework to explain how decision processes evolve and why decisions become forward looking. Our framework provides an alternative to the burgeoning literature about scenario studies, strategic planning and deep uncertainty that has a more normative view on decision making and the role of future aspects therein. The decision-making framework that we develop builds on the Multiple Streams Framework (MSF) developed by Kingdon (2003) and advanced by Zahariadis (2007) and Howlett et al. (2016, 2014). The MSF is especially suited to explain decisions in situations of deep uncertainty and high ambiguity (March, 1991; Zahariadis, 2007). Our alternative framework is therefore particularly useful to explain how decision makers use scenarios, visions, strategies, and flexible solutions in practice and with that, produce forward-looking decisions. Second, we introduce a comprehensive definition of "forward looking", to specify on the basis of what criteria an investment decision can be characterized as forward looking. The definition consists of three evaluative criteria: a problem definition that includes a long time horizon and future developments, a solution that is adaptive or robust to account for uncertainty, and a justification that relies on long-term goals or future scenarios. To illustrate the value of our framework and to provide explanations for why decisions become forward looking, we selected the case of the investment decisions in the IJmuiden sea lock in The Netherlands.

This article is structured as follows. Section 2 presents the MSF and defines the criteria for forward-looking decisions based on a review of different strands of literature. Section 3 describes the research approach and methods of data collection and analysis. Section 4 presents the case findings. Section 5 reflects on the key insights about forward-looking decisions gained from the application of our framework to our case and provides some directions for future research. We end this article with conclusions.

2. Conceptual framework for analyzing and explaining forward-looking decisions

2.1. Framework to understand the process of forward-looking decision making

There are different frameworks to analyze decision making and each framework has its own assumptions about how decision making evolves. Scholars in the field of strategic planning, deep uncertainty, transition theory and forecasting tend to align to rational and linear notions of decision making: they tend to assume or prescribe a decision-making process that evolves according to successive stages and in which a single actor aims at finding the most optimal policy (Albrechts, 2004; Kemp and Loorbach, 2007; Kwakkel et al., 2010; Restemeyer et al., 2016; Wise et al., 2014). However, rational and linear models have mainly prescriptive and descriptive power and are not well suited to explain complex decision making in situations of deep uncertainty and high ambiguity (March, 1991; Zahariadis, 2007). For the purpose of explaining decisions that consider uncertain future developments we need a different perspective to decision making than the rational view.

In this article we propose an alternative model to explain why decisions become forward looking. This model is based on a group of process-oriented decision theories that build on each other, namely the Garbage Can Model (Cohen et al., 1972), Kingdon's Multiple Streams Framework (Kingdon, 1984) including recent advancements by Howlett and colleagues (Howlett et al., 2016, 2014), and the Rounds Model (Teisman, 2000). This group of theories assumes that decision making evolves through more evolutionary and chaotic processes that are characterized by amongst others political conflicts, power struggles and framing contests. The Garbage Can Model portrays the opportunity for a decision as a garbage can into which different problems and solutions are dumped by participants, and where a problems sticks to a solution from time to time (Cohen et al., 1972, p. 2). Kingdon (2003, 1984) modifies this Garbage Can theory to explain why certain problems receive the attention of policy makers and other problems do not. He uses 'streams' to refer to the horizontal and parallel processes of 1) framing problems, 2) developing solution alternatives, and 3) politics. Each stream is characterized with its own specific participants and rules. Kingdon refers to the revised version of the Garbage Can Model as the 'Multiple Streams Framework' (MSF). The metaphor of a stream has been further developed and used to understand decision making and describe the independent and parallel flow of solutions, problems, politics and decision-making processes that develop and change over time (Howlett et al., 2016, 2014). When the streams come together at critical junctures, decisions can be made. Several decisions, and therefore several rounds of decision making, may be needed before a 'definite' solution is chosen (Teisman, 2000). We will briefly explain the key concepts of the MSF that we will rely upon in this study.

The first stream that we distinguish is the *problem stream*. The problem stream consists of different problem definitions, and these definitions can evolve over the course of the decision-making process (Stone, 2002, pp. 242–245). A situation is framed as a problem because certain actors feel something needs to be done to change that situation (Jones and Baumgartner, 2005; Kingdon, 2003). For example, some argue that an urban water system needs to be renewed to use new technologies, whereas others may argue that renewal is needed because urban water systems are unsustainable (de Graaf and van der Brugge, 2010).

The *solution stream* consists of the technical solutions developed by experts and highlighted by specific actors during decision making (Kingdon, 2003; Stone, 2002, pp. 246–247). Solutions for flooding, for example, can include strengthening dykes to prevent flooding or the creation of room for the river through land-use planning (Van Staveren and Van Tatenhove, 2016). Certain actors bring pet solutions to the decision-making process, in search of a suitable problem frame. The solution stream is typically dominated by technical experts and planners that are often strongly guided by their specific disciplinary practice and background (Lawrence et al., 2013).

The *political stream* consists of the political processes of party ideology, elections, coalition changes, and pressure from groups outside of government that cooperate on a certain topic (Kingdon, 2003). A new political administration may not want to increase taxes to renovate urban water systems. Without sufficient political will it is unlikely that investment decisions will be made (DeLeo, 2016; Volkery and Ribeiro, 2009).

The last stream that we distinguish is *the choice opportunity stream*, which consists of the occasions when organizations are expected to produce decisions. The choice opportunity stream includes the rules, procedures, and norms that guide decisions and that determine who is involved and on what basis solutions are examined (Cohen et al., 1972; Howlett et al., 2016, pp. 280–281). Examples are the annual budget cycle, delegations of authority, rules for cost benefit analyses to evaluate possible solutions, and information that needs to be sent to the parliament.

When these four streams meet at a certain juncture, decisions can be made (Howlett et al., 2016, p. 481; Kingdon, 2003, p. 87). The decision that emanates from the joining of the four streams does not necessarily have to be composed of content from all four streams. Also, any of the streams can be the main driver behind reaching a decision; for example, a new government can reframe the problem definition, or technological advancements can create new solutions (Howlett et al., 2014). Multiple decisions may be needed to invest in a new infrastructure. Therefore, following Teisman (2000), we portray the decision-making process in terms of rounds rather than phases. After each decision, the multiple