

Government Attention on Wicked Problems

by

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B.A, Universidad Torcuato Di Tella (Argentina), 2001

M.A, Centro de Investigación y Docencia Económicas (Mexico), 2004

A Dissertation Submitted in Partial Fulfillment  
of the Requirements for the Degree of

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in the School of Public Administration

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University of Victoria

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## **Supervisory Committee**

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Dr. Ana María Peredo, School of Environmental Studies  
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## Abstract

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This doctoral dissertation consists of three separate but related studies that describe and explain government attention on wicked problems as a two-level phenomenon (the individual and the organizational) illustrating basic constituent elements of any attention process: the stimulus, the perception of the stimulus, and the visible actions taken as a response to the way in which the stimulus was perceived. Each study involves different research designs and levels of analysis, viz.: (i) a systematic qualitative review of empirical research on wicked problems (conceptual level of analysis), (ii) a series of psychological experiments based on realistic hypothetical decision making scenarios (individual level), and (iii) a case study of the Department of Fisheries and Oceans of Canada (organizational level).

The first study analyzes key attributes of wicked problems that turn them into stimuli difficult to be addressed using extant models of government attention and traditional decision making approaches. I develop a conceptual framework that explains the main sources of wickedness of public policy problems and their consequences for policy making at government organizations.

In the second study I investigate how arbitrary changes in the presentation of a wicked issue (i.e., problem framing) affect policy decisions. The study was designed to test the presence of behavioural anomalies and decision biases when people tend to reason and make decisions on wicked problems in scenarios involving policy decisions in the field of socio-ecological sustainability. Based on the results of this study, I develop a causal model that explains how the manipulation of problem definitions has an influence on policy responses and on the attitude of the participants regarding those responses.

The third study analyzes the outputs of attention allocation processes in a public organization. This is a case study that explains how two types of events interrelate to make up an organizational process of attention, viz.: the issues that are identified as critical and important in matters related to the sustainability of Pacific salmon in British Columbia as a wicked problem, and the answers deployed by the Department of Fisheries and Oceans (DFO) to deal with it during two attention cycles, 1990-93 and 1994-98. Through the comparison of these attention cycles I was able to identify a longitudinal pattern of attention, understand how wicked problems evolve over time, and determine some form of causality that explains why certain governmental responses to a wicked problem have been applied in such specific context and period of time.

By synthesizing and integrating the findings of the three studies, this doctoral dissertation provides a better understanding of, and an alternative approach to, the process of attention on wicked problems at public organizations.

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## Dedication

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To my mother, Felicita, my sister, Wilma, and my nieces, Iara and Candela, for their invaluable support in all my endeavours.

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## Chapter 1. Introduction

This doctoral dissertation provides a better understanding of, and an alternative approach to, the process of attention on wicked problems at public organizations. The concept *wicked problem* was first introduced more than half a century ago by Horst Rittel—a German mathematician, physicist, chemist, sociologist and experienced operations researcher at the University of California, Berkeley—to depict a distinctive “class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, where the ramifications in the whole system are thoroughly confusing...[and] where proposed 'solutions' often turn out to be worse than the symptom” (Churchman, 1967: B141). Thus, the term *wicked* is used here not in the sense of evil or ethically unacceptable, but to denote highly complex, uncertain and intractable societal issues that are ambiguously defined and highly resistant to resolution (Rittel, 1972; Rittel and Weber, 1973). A few examples of pressing policy challenges usually defined as wicked problems include: climate change, economic inequality and poverty, water governance, and fishery and coastal management.

Extant theories and models of government attention are inspired by rational models of individual and organizational punctuated decision-making that are not particularly designed to deal with problems of a wicked nature. The mainstream approaches to government attention, such as the agenda-setting and the rulemaking literatures, have deployed their analytical tools to examine the preparedness and response capabilities of public managers and elected officials to deal with very specific critical events. Hoffman and Ocasio (2001) and Nigam and Ocasio (2010) define *critical events* as contextually dramatic happenings that focus sustained attention and invite the collective definition and redefinition of social issues. The terrorist attacks of 9/11 (May, Workman and Jones, 2008), massive oils spills (Birkland, 1997; Hoffman and Devereaux-Jennings, 2011), airplane accidents (Sullivan, 2010; Cavazos and Rutherford, 2011) or internal scandals (Kemp, 1984) are examples of critical events that have been thoroughly analyzed to reveal factors and mechanisms that evoke political and bureaucratic attention understood as an institutional, formal allocation of financial resources, personnel, time and/or

structural capacity to solve a specific, well-identified issue, such as an industrial accident or a natural disaster.

The literature on government attention –mostly based on positivistic approaches applied to policy analysis– demonstrates that critical events interrupt long periods of policy stability and trigger punctuated decision-making models; in other words, non-incremental policymaking patterns that: (i) start with identifying a problem to attend to, (ii) assess the dimensions and attributes of the issue (i.e., ‘problem definition’), (iii) search for alternatives, (iv) sort through potential solutions, and (v) make the final policy choice to respond to an infrequent contextual change (e.g., Jones and Baumgartner, 2005; Breuning and Koski, 2009; Mortesen, 2005; see also Scott, 2006 and Pump, 2011). Contrary to policy issues that can be addressed through such linear methods of problem solving, wicked problems are not only difficult to be clearly defined and disaggregated into its constituent parts, neither is it possible to establish a ‘stopping rule’, a definitive, clear and correct solution that would make the problem disappear (Rittel and Weber, 1973). When trying to tame a wicked problem “you can always try do better and there is nothing in the nature of the problem which could stop you”, says Horst Rittel (1972: 392) in his seminal article on the challenges of attacking societal problems in a rational, straightforward and systematic way.

The current literature on attention and decision making in the public sector is unable to explain clearly how government attention unfolds when public officers deal with problems that inhabit environments where traditional planning theories do not seem to work. In order to advance the understanding of government attention on wicked problems, at least the following aspects need to be taken into consideration. First, whether at individual or organizational level, attention is usually conceived of as a limited-capacity and scarce resource that determines how relevant stimuli are perceived while ignoring irrelevant distractors (e.g., Dearborn and Simon, 1958; March and Simon, 1958; Cyert and March, 1963; Kahneman, 1973; March, 2008; Khetrapal, 2010; Yaniv and Schwartz, 2011). The way attention is allocated in the public sector is critical to examining when, where, and how policy makers search for information about urgent problems, alternatives, and their consequences (March and Simon, 1958). Understanding the process of attention at the organizational level is thus crucial to explain organizational

behaviours in light of the various contingencies, factors and mechanisms that have an impact on organizational outcomes, the agenda building process, budget and organizational changes, and regulatory decisions (Peters and Hogwood, 1985; Mortesen, 2005; West, 2005; May et al., 2008; Breuning and Koski, 2009; Sullivan, 2010; Cavazos and Rutherford, 2011; Ferreira, 2011; Pump, 2011).

Second, by its nature, attention is selective and meant to cease: individuals and organizations have a limited attention span and, eventually, they will concentrate on different stimuli and tasks to perform. This ephemeral aspect of attention is a major challenge to tackle wicked problems that require sustained attention over a long period of time, and cooperative and networked strategies to be addressed effectively (APSC, 2007; Conklin, 2008; Fitz Gibbon and Mensah, 2012; Grint, 2008; Head, 2010; Khan and Neis, 2010; Head and Alford, 2008; Roberts, 2000).

Third, there are other relevant cognitive aspects involved in supplementary processes of conflict resolution and problem solving, such as the definition and the enactment of the problem itself, that are worth considering when analyzing attention patterns on highly conflictive societal issues (Ocasio, 2011). These additional components are indeed relevant for comprehending the outcomes of any policymaking cycle but they have not been analyzed in detail by extant literatures on attention in the public sector.

Fourth, from a methodological point of view, mainstream research on government attention has been dominated by variance theories that consist of explanations of independent variables (e.g., media coverage, gubernatorial power, the number of problems that compete for attention) that statistically explain variations in some outcome criteria or dependent variables (e.g., budgetary outcomes, organizational changes, the length of regulatory processes, the rate of proposing and finalizing rules) (Van de Ven and Huber, 1990). Several studies have developed the idea of collective attention as a process rather than only as an input (stimulus)-output (response) relation, but these have been largely focused on the level, nature and dynamics of public attention (Downs, 1972; Nigam and Ocasio, 2010; Hoffman and Devereaux-Jennings, 2011) or on the firm and industry-level of attention (e.g., Ocasio, 1997; Hoffman and Ocasio, 2001; Isabella, 1990; Barr, 1998). On the contrary, a process approach to attention at government organizations, able to identify the interrelationship of policy issues and responses over

time and to explain causal underlying mechanisms and attention patterns, still remains largely unexplored. Extant models of government attention mainly emphasize attention outcomes or structures, but perhaps this is because we have not had particularly good ways of modeling or measuring the obvious mediating variable: the process itself. Peters and Hogwood (1985) study on the cycle of attention in the public sector, for example, measures political attention in terms of organizational changes aggregated in big policy areas and decades; however, there is no explanation of how specific stimuli trigger the attention cycles and how the process of attention evolves over time.

In order to contribute to fill these theoretical and methodological gaps, this research's **overarching goal** is to explain in real decision making scenarios and public policy processes how certain events and issues lead to interrelated governmental responses, how policy responses are affected by contradictory definitions of a wicked problem and individual values, what attention patterns are created over time by the interplay of issues and answers, and which procedures and heuristics work or don't work to respond creatively and effectively to wicked problems. The **primary contribution** of this doctoral dissertation is to advance on an area that has received little interest by the mainstream organizational literature: the nexus between government attention and wicked problems. Some researchers have noted that, although we have a long history with wicked problems, the complexities and uncertainties of managing these social issues have been largely unexamined (Head, 2010; Brown et al. 2010; Norton, 2012; Roberts, 2000). This research offers a variety of systematic and reliable methods for analyzing empirically how individuals and public organizations address uncertain, complex and dynamic social and ecological issues, as it is further explained below.

### **Research Questions**

The main purpose of the attention process, which is essential for human behaviour, is to selectively concentrate on a discrete aspect of information, object and /or event for a period of time, while simultaneously ignoring irrelevant stimuli that are also occurring in order to inhibit inappropriate responses or to activate appropriate ones. At organizational level, attention is defined as the socially structured pattern of behavioural and cognitive processes by decision makers within an organization, which converts stimuli into actions as a response to, or in anticipation of, environmental changes (Ocasio, 1997). In any

attentional process there are three basic constituent elements (Kahneman, 1973): a stimulus (i.e., a process input), the perception of the stimulus (i.e., framing stage), and the visible actions taken as a response to the way in which the stimulus was perceived/framed (i.e., process output).

As said above, wicked problems are a particular class of societal issues that have no definitive formulation and cannot be attended and solved in the same linear and punctuated way as clearly defined critical issues that mainstream theories of attention in the public sector have focused upon. It is worth asking then what a process of government attention actually means when policymakers deal with wicked policy problems, and how they affect decision making in the public sector. In order to provide a more comprehensive explanation of the process of attention on wicked problems at public organizations, firstly I analyze each of the aforementioned basic elements of an attention process in **three separate studies**, and then I integrate and synthesize their findings to discern theoretical and practical implications. Each study is made up of two chapters: one describes data collection techniques and data analysis procedures, and the other presents and discusses research findings. The integration and synthesis of the three studies is shown in the last concluding chapter.

The first study (Chapters 3 and 4) is focused on explaining wicked problems as stimuli; more specifically, why certain characteristics of policy problems defined as *wicked* make difficult to attend to and address them using extant models of government attention and traditional decision making approaches. Study #1 is aimed at answering the following research questions:

- (i) What are the main sources of wickedness of public policy problems? What are the challenges that such sources of wickedness pose for policy and decision making processes in the public sector? What are the problem-solving strategies that have been proved successful in addressing wicked policy problems? What are the factors that contribute to the success or failure of such solutions?

The second study (Chapters 5 and 6) is based on the stage dedicated to the perception and framing of a wicked problem as a stimulus, which shapes the focus of attention and

provides incentives and/or preferences for certain actions over others. Study #2 addresses the following research questions:

- (ii) How does the framing of a wicked problem affect the way in which solutions are perceived? What are the factors that explain the influence of framing on attention and decision making at individual level?

The third study (Chapters 7 and 8) analyzes the outcomes of the organizational attentional process; more specifically, how certain visible actions (e.g., routines, projects, programs and/or procedures) are taken in response to a wicked problem (i.e., an environmental stimulus) that has been previously noticed, interpreted and brought into conscious consideration of decision makers within a public organization. The research questions answered through Study #3 are:

- (iii) How does the attention process of public organizations on a wicked problem emerge, develop, and (perhaps) eventually decay? What are the main policy patterns and outcomes that attention processes on wicked problems generate over time at an organizational level of analysis?

Thus, this research analyzes attention as a two-level phenomenon: the individual (i.e., the decision maker) and the organizational (i.e., the situation in which the decision maker operates) (Ocasio, 1997). The goal is to expose some formal and informal mechanisms in and across levels of analysis. Although it is acknowledged that the relationship between individual- and organizational-level of attention is complex and still under-investigated (Ocasio, 2011), it is possible to identify certain commonalities that connect both levels in a useful way. For instance, organizational attention, like human attention, is a limited resource. Organizations and individuals have limited attention capacity and, therefore, they both must select from among the many potentially available stimuli and respond to these selected stimuli only (Yaniv and Schwartz, 2011). Moreover, the extent to which individual decision makers are selective in their attention to certain environmental stimuli and not to others is a significant predictor of organizational decisions and performance (Dearborn and Simon, 1958).

Each of the three studies involves different research strategies. Study #1 is a systematic qualitative review of empirical research on wicked problems whose findings are useful to

describe this field of research, theories and research methods used to empirically analyze wicked problems, the plurality of existing definitions and problem solving approaches, and practical propositions that help improve the chances of success for wicked problem-solving approaches. Study #2 consists of a series of psychological experiments based on realistic hypothetical decision making scenarios, which analyzes how arbitrary changes in the definition of a wicked issue (i.e., problem framing) affect policy decisions and influence individual behaviour. Study #3 is a case study of the Department of Fisheries and Oceans of Canada (DFO), which establishes some form of causality into a course of events to explain why certain organizational responses to a wicked problem have been applied in a specific context and period of time.

Overall, this doctoral dissertation can be defined as a descripto-explanatory research. It is descriptive in the sense that, based on the systematic synthesis of empirical research, it initially aims “to portrait an accurate profile of persons, events or situations” (Robson, 2002: 59) that make a societal problem wicked. Study #1 is a descriptive secondary research that provides a clear picture of this particular type of societal issues. Its goal is to understand the wicked dimensions of sustainability problems, its causes and consequences on policy making and attention processes, and which and why certain solutions have been relatively successful. The main outcome of Study #1 is a general conceptual framework on the wickedness of policy problems in the field of sustainable development, which is robust and theoretically well founded but also flexible and simple enough to inform data collection and analysis of the other two studies.

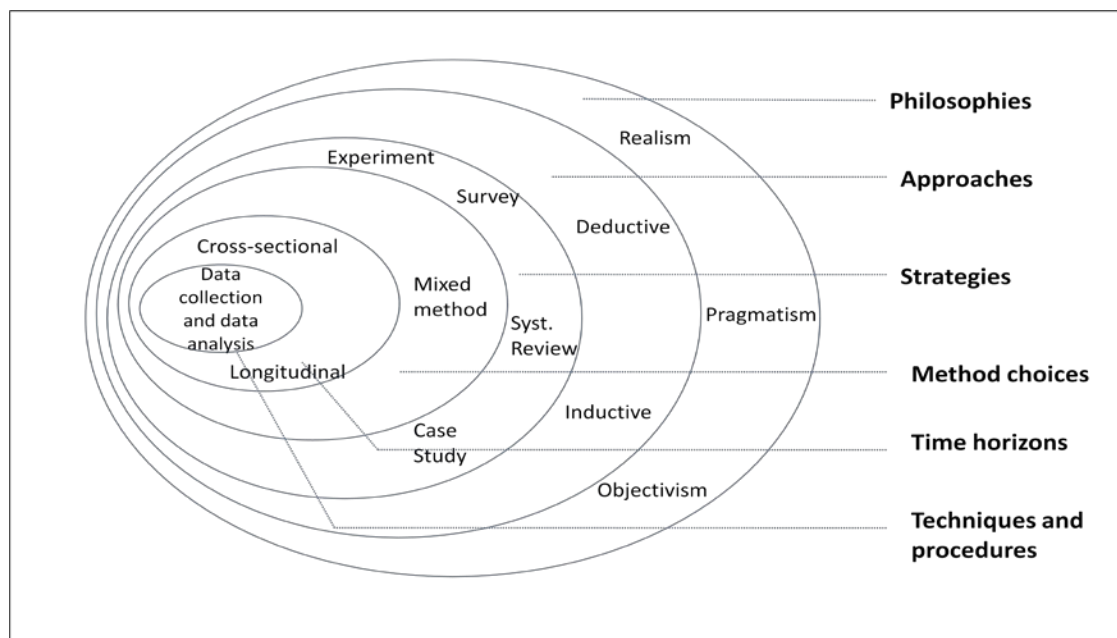
This research is also explanatory in the sense that the goals of the second and third studies are to establish causal relations between variables, respectively: the effects of different framing conditions on individual decision making, and the historical causal structure of issues and answers that form organizational attention processes and patterns. Study #2 is designed in way that it can advance research on micro-oriented aspects and discrete judgments made by individuals when it comes to making decisions around wicked problems. The use of insights from behavioural science contributes to the study of human behaviour and attitudes, but it also has the capacity to inform research on individuals, groups and organizations in public administration settings (Bozeman, 1992; Bozeman and Scott, 1992; James, Gilke and Van Ryzin, 2017; Grimmelikhuijsen et al.,

2017). The experimental research contributes to a more complete understanding of micro-level behaviours (i.e., framing effects) underlying macro-level phenomena (i.e., attention to societal events) examined in a case study on DFO and the sustainability of Pacific salmon in BC in Study #3.

## Research Design

Given the diversity of studies that make up this thesis, it is important to understand how they are related, what the underlying logic and belief system connecting them are, and how they inform each other to provide a more comprehensive picture of the research topic. This section describes the research design that guides this work based on the research onion model developed by Saunders, Lewis and Thornhill (2009) (see Fig. 1.1). This section is concerned with the first five layers of the onion: 1) research philosophy; 2) research approach; 3) research strategy; 4) method choices; and 5) time horizons. The sixth layer –i.e., data collection techniques and analysis procedures for each of the three studies– is presented in separate chapters, as explained above. Those methodological chapters provide more specific details about the research strategies chosen to answer each set of research questions.

**Figure 1.1. The research onion**



Source: own based on Saunders et al. (2009)

**Research philosophy (first onion's layer)**

Research philosophy is an overarching term that refers to the relationship between knowledge and the process by which it is developed. The knowledge production process and the nature of that knowledge are based on important assumptions about what reality is that underpin the research strategy and the methods chosen as part of that strategy (Saunders et al., 2009). Understanding a researcher's underlying philosophical position is an integral and necessary task for her/him to argue for different research approaches, to choose confidently one's own philosophical choices, and to be able to defend it in relation to other alternatives that could have been adopted.

In this case, the adoption of a philosophical stance has to take into account the diverse set of research questions guiding this doctoral dissertation and their different levels and units of analysis. Given that my research questions do not suggest unambiguously that either a positivist or interpretivist philosophy should be followed, I adopt a pragmatist's philosophy that argues that the most relevant determinant of the epistemology, ontology and axiology chosen by a researcher and the design of her/his research methods is the research question(s) (Saunders et al., 2009). Building on Tashakkori and Teddlie's (1998) idea of research philosophy as a continuum rather than as opposite positions, pragmatism accepts that one choice may be more appropriate than the other for answering particular questions, and that it is perfectly possible to work with variations in epistemology, ontology and axiology depending on the question to be answered. In this sense, pragmatism means that the quality of a study needs to be judged by its intended purposes, available resources, procedures followed and results obtained, all within a context and for a specific audience (Patton, 2002). Recognizing that different methods are appropriate for different reasons, under the pragmatic philosophy of science methodological orthodoxy is eschewed in favour of methodological appropriateness as the primary criterion for judging methodological quality (Patton, 2002). The role of pragmatism as a research philosophy is thus contingent on the ultimate success of the resultant research (Dobson, 2002).

**Ontology**

The term ontology refers to the nature of reality; more in particular, how the world operates and how valid knowledge about the world is produced. Two common

ontological stances debated in the social sciences are subjectivism and objectivism. The former is mainly concerned with understanding the meanings that individuals attach to social phenomena, how meanings are created from the perceptions of social actors, and how a continual process of social interaction put these social phenomena in constant state of revision (Saunders et al., 2009). The subjectivistic ontology is usually associated with the sociological theory of knowledge known as social constructivism that aims to answer the question of how subjective meaning becomes a social fact institutionalized in reciprocal interactions between actors (Berger and Luckmann, 1966). Following from the interpretivist philosophy, social constructivism conceives of reality as being socially constructed and re-constructed through a complex array of phenomena that include social interactions and physical factors to which individuals attach certain meaning, rituals and myths. Interpretivism, as research philosophy, rejects reducing the complexity of reality to law-like generalizations, and focuses on understanding differences between humans in their role as social actors and how those roles are interpreted in accordance with the meaning people give to them (Patton, 2002; Saunders et al., 2009).

On the contrary, the objectivistic ontology argues that social entities exist in a reality that is both external and independent to social actors. Accordingly, objective, mind-independent aspects of reality are more important than the way in which actors attach their own individual meanings to it. Objectivism assumes that there is an objective truth that exists outside individuals' subjective biases, interpretations and feelings. The existence of social phenomena in an objective world implies that there exist some lawful and reasonably stable relationships and social regularities, and the task of a social scientist is to express them as precisely as possible, attending to their range and generality and to the local and historical contingencies under which they occur (Miles and Huberman, 1994). From an objectivist stance, selected research methods have to be able to capture, interpret and explain those social relationships and their causes, and allow others using the same methodological tools to arrive at similar conclusions (Miles and Huberman, 1994).

Considering the goals of this study, more specifically, the search for regularities and commonalities among wicked sustainability problems based on core content patterns and themes across a diverse set of empirical studies, as well as causal relationships between

problem frames and policy decisions, and attention patterns that could be analytically generalized to theoretical propositions (Yin, 2009), the adoption of an objectivistic ontology is an appropriate decision to conduct this research.

### Epistemology

In general terms, this concept addresses the question of what acceptable knowledge is in a particular field of study. In line with the adopted objectivistic ontology, this research follows two different, but related, epistemologies: positivism and critical realism. The first one works with an observable social reality that produces credible data, and the research conducted on such reality can help develop law-like generalizations similar to those produced by the traditional scientific approach (Remenyi et al., 1998). Usually the way to proceed under the positivistic epistemology is to use existing theory to develop hypotheses that are later tested, confirmed or rejected, leading to further development of new theory or refinement of existing ones. The sources of knowledge are *facts* –rather than beliefs, impressions or embedded meanings– that depict an observable social reality derived from a sensory experience interpreted through reason and logic (Saunders et al., 2009). Those facts provide verifiable data –i.e., empirical evidence– that help discern general laws about how social phenomena operate. Scientific knowledge is thus limited to what can be logically deduced from theory, operationally measured, and empirically replicated (Patton, 2002). As it is further explained in Chapter 3, Study #2 is based on an experimental design that follows a statistical hypothesis testing procedure and a highly structured methodology that facilitates replication, which is critical for a positivist approach to research as it helps ensure reliability (Gill and Johnson, 2002).

The second philosophical position adopted in this research is called realism. It is related to positivism as it also assumes an approach to the development of knowledge akin to the position of natural science. The essence of realism is that what the senses show us as reality is the truth and, therefore, that reality is independent of the mind of who perceives it (Saunders et al., 2009). Generally speaking, there are two forms of realism: direct realism and critical realism. The former sustains that what people experience through their senses portrays the world accurately. The latter attributes an important role to our senses; in particular, it suggests that what we experience are actually sensations, images of things in the real world, rather than things directly.

According to the critical realists, the way the world is experienced proceeds in two steps: first, there are things in reality that convey sensations; second, the knowledge about reality is a result of social conditioning and cannot be understood independently of the social actors involved in the knowledge production process (Dobson, 2002). Direct realists argue that the first step is enough to experience the world as is.

Another important difference between these two forms is that direct realism assumes that the world is relatively unchanging and can be understood conducting research on a single aspect or level of a social situation (e.g., the society, the individual, the group or the organization). Critical realism, on the contrary, argues that the social world changes constantly and it underscores the importance of a multi-level perspective in which each level has the capacity to change the researcher's understanding of the object of study (Saunders et al., 2009). Based on the understanding of society as "an ensemble of structures, practices and conventions that individuals reproduce or transform" (Bhaskar, 1991: 76), the critical realist epistemology advocates a relational perspective between levels of analysis to increase the explanatory power of research. According to this epistemological stance, in order to practically investigate a social phenomenon one may need to examine each level separately, but the interactions between each structure identified at the different levels cannot and should not be ignored (Layder, 1993). The choice of a critical realist position is thus consistent with the purpose of understanding the three basic element of a process of attention and exposing causal relations in and across levels of analysis.

The critical realist epistemology followed in this research is derived from the work of Bhaskar (1986, 1991) who argues that reality and the value-laden observation and representation of reality operate in different domains, viz.: a transitive epistemological dimension and an intransitive ontological dimension. Critical realism assumes the existence of two worlds, an intransitive world that is natural and relatively unchanging, and a transitive world that is social and historical. In fact, in an interview with Norris (1999: 49), Bhaskar recognizes that "there is no conflict between seeing our scientific views as being about objectively given real worlds, and understanding our beliefs about them as subject to all kinds of historical and other determinations". From a critical realist

approach, reality can never be a social product since it pre-exists the transitive, changing social analysis of it.

For the critical realist researcher, the most important driver for decisions on methodological approach is the intransitive ontological dimension, whereas the target of research is to bring to light the real enduring aspects, mechanisms and structures underlying perceived events upon which the realist researcher should concentrate (Dobson, 2002). Realist explanations of social phenomena are not based on covering laws, general propositions or the deductive logic of classical positivism, but they flow from an account of how particular configurations produce the events under examination, looking for “an individual or a social process, a mechanism, a structure at the core of events than can be captured to provide a causal description of the forces at work” (Miles and Huberman, 1994: 4).

This approach to social reality is based on the assumption that there are relatively stable social relationships and regularities. This belief is consistent with Study #1’s goal of identifying core consistencies and thematic patterns in seemingly random information about wicked sustainability problems, and establishing valid and verifiable relationships between the wickedness dimensions of sustainability problems and their implications on policy making in diverse settings and decision scenarios. It is also consistent with Study #3’s purpose of explaining how societal events may be related across different decision situations, seeking attention patterns and causal connections that could be used for analytical purposes and theory testing and refinement.

Positivism and direct realism are reality-oriented approaches consistent with an objectivistic ontology. Both epistemologies are able to address central questions related to what can be established with some degree of certainty about what happens in the “real world”, what plausible explanations are for verifiable patterns, and how we can study a phenomenon so that our findings correspond, as much as possible, to the real world (Patton, 2002).

### Axiology

This branch of philosophy is concerned with the roles that the researcher’s values play in her/his research choices and in all stages of the research process, including the selection of the philosophical approach and data collection techniques. The pragmatist

philosophy adopted in this doctoral research argues that values play a large role in interpreting results, with the researcher adopting both objective and subjective points of view (Saunders et al., 2009).

Study #2 (experimental design), which follows a positivist epistemology, is conducted in a value-free way regarding how data are collected and analyzed. As a researcher, this involves being independent of the data and maintaining an objective stance regarding the empirical evidence. The interpretation of results –including the establishment of causal links between independent and dependent variables, and intermediate factors that help understand that causal relation– is based on a variety of statistical tests, as further explained in Chapter 5. Studies #1 and #3 are conducted adopting a critical realistic epistemology that assumes the observation of reality is value laden and, therefore, the interpretation of qualitative data and research findings could be influenced by my own world views, cultural experiences and personal values.

The overall synthesis and integration of the three studies are undertaken from a post-positivist axiological stance that recognizes that judgment is unavoidable in science, that proving causality with certainty in explaining social phenomena is problematic, that knowledge is embedded in specific paradigms and is therefore relative rather than absolute, that all methods are imperfect, and that both quantitative and qualitative research strategies are needed to generate, test and refine theory (Patton, 2002).

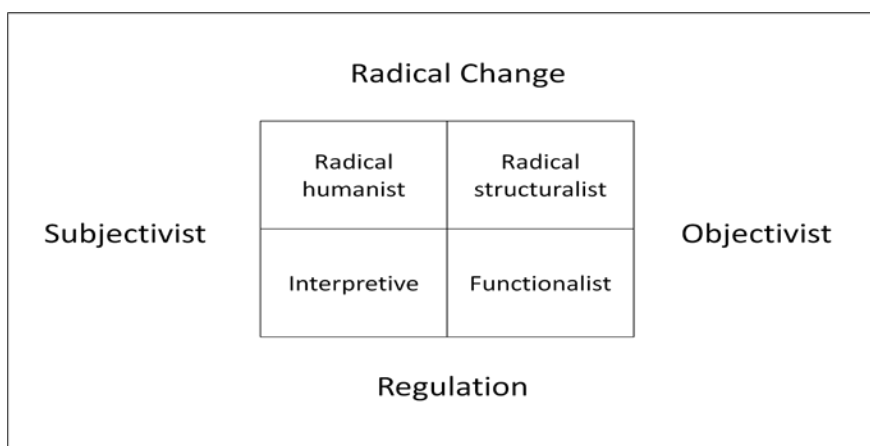
### Research paradigms

The term paradigm has multiple meaning when it is used in the social sciences. In a nutshell, a paradigm is an alternative way to reflect upon epistemological and ontological decisions as it refers to the way in which a researcher examines social phenomena from which particular understandings can be gained and explanations attempted (Saunders et al., 2009). A research paradigm is vital for understanding the purpose and intention of the proposed research design, as well as the methods and techniques that shape the work of gathering and analyzing data and disseminating results (Givens, 2017).

Burrell and Morgan (1982) propose four paradigms for the analysis of social theory, which are useful for identifying in a relatively simple way the choices made in the design of this doctoral thesis. These authors discuss the following categories of social science paradigms: functionalist, interpretive, radical humanist, and radical structuralist. These

are arranged to correspond to four conceptual dimensions: radical change *versus* regulation, and subjectivist *versus* objectivist (Fig. 1.2).

**Figure 1.2. Four paradigms for the analysis of social theory**



Source: Saunders et al. (2009)

The distinction between subjectivism and objectivism was previously discussed in the ontology sub-section. The difference between the radical change dimension and the regulation dimension is that the former approaches social problems from the viewpoint of overturning the existing state of affairs, whereas the latter seeks to work with existing states of affairs. The radical change perspective adopts a critical approach to social life, and it is aimed at providing recommendations about how affairs in society should be conducted. The regulatory perspective is less judgmental and critical of the status quo (Burrell and Morgan, 1982; Saunders et al., 2009).

Being consistent with the ontological position adopted, my research paradigm falls under the vertical, objectivist dimension and it can be generally defined as structural functionalist. It is functionalist in the sense that this is a problem-oriented research aimed at providing rational explanations of why and how particular wicked problems occurred, and developing a set of recommendations and practical solutions to deal with them. It is structuralist because it is concerned with objective entities –such as societal events, embedded power relationships and patterns of conflicts in organizational and social structures– that play a critical role in understanding the occurrence of wicked problems. The structural functionalist paradigm is particularly appropriate for this research on wicked problems because, from a macro-level orientation, it sees society as a complex

system shaped by its social structures (i.e., patterned social arrangements) that are both emergent and determinant of individual and collective actions (Macdonis and Gerber, 2010).

To better explain how wicked problems operate and public organizations deal with them, the paradigm used here is inspired by the works of Merton (1957) and Almond and Powell (1966). The former emphasizes the existence of structural dysfunctions and/or deviations in any modern complex society (i.e., not all parts of the system work for its functional unity or stability), the central role played by power and conflict in this regard, and how things within the system can be changed through innovation (Holmwood, 2005). Understanding the way in which conflicts emerge in a social system and influence policy responses, and which novel or unaccepted methods are needed to tame wicked problems –as it is recommended by Rittel and Webber (1973)– cannot be easily disregarded when conducting research on this topic.

Almond and Powell (1966) introduce a structural functionalist approach to the analysis of political systems. They argue that a political system is made up of several key components, including interest groups, political parties and branches of government, each of them trying to impose their values, habits and beliefs, and to generate interest, engagement and participation from citizens according to the values and information they proclaim. Almond and Powell propose that in order to understand a political system (or a policy sub-system such as the Fraser River watershed that Study #3 focuses on) it is necessary to analyze not only its structures or institutions (as the Department of Fisheries and Oceans) but also their respective functions in a meaningful and dynamic historical context. This stance is in line with Rittel and Webber's (1973) critique to the mechanistic view of the system approach of the first generation (see Chapter 2) that conceives of all political systems as essentially the same, subject to the same laws of stimulus and response –i.e., inputs and outputs–, while little attention is paid to contextual characteristics that are critical for comprehending the uniqueness of any wicked problem.

### **Research approaches (second onion's layer)**

Selecting between inductive and deductive approaches is important for making informed decisions about the overall research design, not only in terms of data collection techniques and analytical procedures, but also regarding what kind of evidence is

gathered and from where, how such evidence is interpreted in order to provide good answers to the research questions, and which research strategies works best to do so (Saunders et al., 2009). In accordance with the pragmatist philosophy adopted here, I decide to combine both approaches depending on the set of questions I intend to answer.

The literature suggests that not only it is perfectly possible to combine deduction and induction within the same piece of research, but also it is often advantageous to do so (Patton, 2002; Saunders et al., 2009). Creswell (2002), a world-renowned scholar on mixed methods research, argues the most important aspect to define a research approach is the emphasis of the research and the nature of the research topic; this is: a deductive approach is more helpful when there is a wealth of literature on a topic from which it is possible to define a theoretical framework and hypotheses; whereas in research into a topic that is relatively new and there is little existing literature, it is more appropriate to work in an inductive way by generating and analyzing data and reflecting upon theoretical themes the data are suggesting. In other words, neither approach should be thought of as better than the other. They are better at different things and can be combined in a single study, depending on where the research emphasis lies.

Following Creswell's suggestion, I use a deductive approach in Study #2 to test the application of Prospect Theory and the presence of framing effects (Kahneman and Tversky, 1979; Tversky and Kahneman, 1981) in decision situations involving wicked sustainability problems. Through an experimental research design, I follow all the sequential steps of deductive research that goes from deducing hypotheses from theory, making terms operational and measurable quantitatively, selecting samples of sufficient size in order to generalize conclusions, testing hypotheses, confirming or rejecting the theory, and modifying the theory in light of the experimental results (Robson, 2002). Studies #1 and #3, on the contrary, are undertaken from an inductive approach. Using less rigid, qualitative methodologies that permit changes of research emphasis as the research progresses, both inductive studies are able to offer alternative explanations that contribute to the development of new theory on wicked problems and government attention. These two studies put a stronger emphasis on the unique contexts in which wicked problems and related events take place, and use a variety of methods to collect data that help incorporate different views of such phenomena in the analysis (Easterby-

Smith et al., 2008). The strategy of inductive designs followed in both studies is to allow the important analysis dimensions to emerge from patterns –i.e., thematic and attention patterns– found within and across cases under examination and their underlying logical arguments, without presupposing in advance what the important dimensions would be (Patton, 2002; Eisenhardt and Graebner, 2007).

Thus, this investigation flows from an inductive approach to find out what the important wickedness dimensions in sustainability problems and their implications for decision making are in the public sector (Study #1), to deductive hypothesis-testing and outcome measurement procedures aimed at further investigating and generalizing previously identified findings on conflictive definitions of wicked problems (Study #2), and then back again to inductive analysis to look for rival explanations on the role of conflict and problem framing of wicked sustainability issues in government attention processes (Study #3).

### **Research strategies (third onion's layer)**

Consistent with the pragmatist philosophy followed here, it is assumed that no research strategy is inherently superior or inferior to any other, that they are not mutually exclusive, and that it is possible to tactically mixing methods as needed and appropriate (Patton, 2002). The selection of research strategies –which is briefly describe below and further explained in separate methodological chapters– is thus based on their capacity to answer the research questions and meet the objectives of this dissertation, the extent of existing knowledge, the amount of resources available, and the philosophical underpinnings presented above.

Study #1 consists of a qualitative systematic review of empirical research on wicked sustainability problems, which is based on a transparent and reproducible process aimed at generating research findings that are as rigorous as those obtained from primary research (Gough et al., 2013; Greenhalg et al., 2005). Mainly aimed at developing new insights and contributing to building new theory, I conduct a configurative synthesis that, using content analysis, aggregates data at a conceptual level in order to draw theoretical insights about the wickedness of sustainability problems and their implications for problem-solving in the public sector. Content analysis is referred as a data reduction and sense-making effort that takes a volume of qualitative material and attempts to identify

core descriptive findings (i.e., patterns) and more categorical findings (i.e., themes) (Patton, 2002).

Study #2 is an experimental research on framing effects and decisions made to address wicked sustainability problems. This is a relatively simple experiment concerned with whether there is a causal link between framing conditions (independent variable) and solutions chosen by the participants to address a wicked problem (dependent variable). Instead of using a control group where no intervention is made, the participants are randomly assigned to two different experimental groups where the only difference between them is the framing conditions of a wicked problem each group receive. By assigning participants to each group at random, changes to the dependent variable should not be attributed to differences in the composition of the groups. This helps remove possible effects of an alternative explanation to the manipulation of frames and helps eliminate threats to internal validity. In other words, if the results between experimental groups differ significantly, changes in the dependent variable can be only explained by the different problem frames each group has to work with.

In the search of intermediate factors that can help explain that causal relationship, this second study also uses a questionnaire on protected values regarding the environment (Baron and Spranca, 1997), more specifically in terms of its preservation and utilization. As with experiments, the questionnaire strategy is associated with the deductive approach. The collected data is analyzed quantitatively using descriptive and inferential statistics for hypothesis testing purposes. The statistical results are used to suggest possible reasons for particular relationships between dependent and independent variables and to produce a causal model of these relationships, as shown in Chapter 6.

Study #3 is an explanatory case study on the sustainability of wild Pacific salmon in British Columbia, Canada. It will help gain a rich understanding of this wicked problem, its contextual characteristics, the government attention process on this issue and the attention patterns created over a specific period of time. This study employs diverse data sources, such as interviews, official documents and newspaper articles, which are combined and triangulated to ensure the accuracy of the qualitative evidence used. The analysis is conducted through a novel methodology for the study of wicked problems and

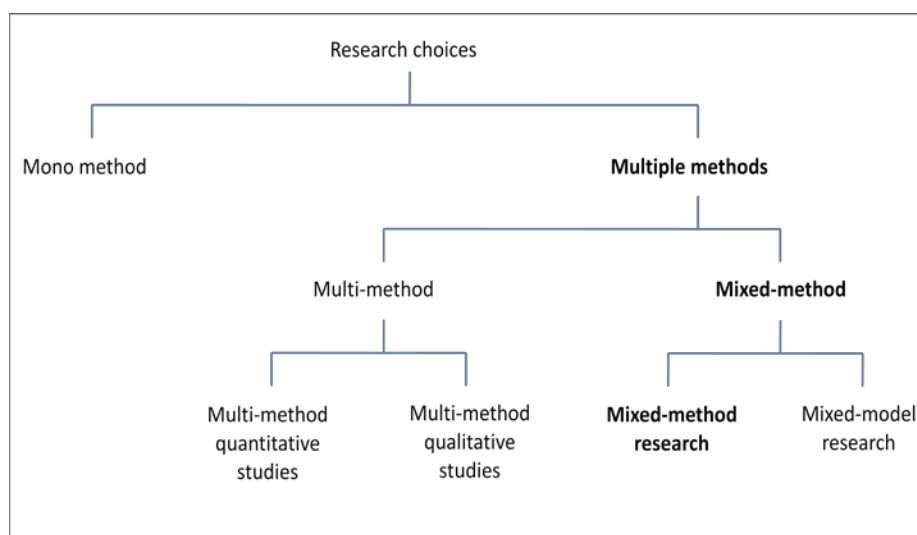
attention processes at public organizations: the event-structure analysis (ESA) developed by David Heise (1989, 1991, 2012), a social psychologist from the University of Indiana.

ESA is a method largely inductive focused on finding particular explanations about how an outcome is produced by a chain of events. In order to link events into cause and effect relationships, ESA is based on particular assumptions with regard to human action. The basic process theory on which it relies is the theory of rational action developed in cognitive science, which assumes that when actors create an event they make rational choices on the basis of what they know about the situation at that moment in time (Newell and Simon, 1972; Heise, 1989). This theoretical assumption allows drawing causal inferences with regard to how actions create particular circumstances and/or events that are then contemplated to rationally decide on the next action (Sminia, 2009). The use of ESA is consistent with the research approach, paradigm, axiology, epistemology and ontology chosen to conduct this third study.

#### **Method choice (fourth onion's layer)**

A broad and inclusive definition of a research method encompasses data sources, measurement approaches and analytical techniques (Molina-Azorin et al., 2017). Based on what is mentioned above and using the categories proposed by Saunders et al. (2009), this doctoral dissertation can be labelled as a mixed-method research (see Fig. 1.3 below).

**Figure 1.3. Research method choices**



Source: Saunders et al. (2009)

First of all, since I use more than one data collection technique and analysis procedure to answer my research questions, this can be considered a *multiple methods research*. Second, it adopts a *mixed-methods approach* as both qualitative (Studies #1 and #3) and quantitative (Study #2) data collection techniques and analysis procedures are used in the research design. This is different from a multi-method approach that refers to combinations of more than one data collection technique and analysis procedure, but that are restricted to either a quantitative or a qualitative approach (Tashakkori and Teddlie, 2003; Molina-Azorin et al., 2017). Finally, within the mixed methods approach, this thesis can be categorized as a *mixed method research* as both quantitative and qualitative data collection techniques and analysis procedures are used sequentially one after the other but they are not combined. In other words, quantitative data are analyzed quantitatively and qualitative data are analyzed qualitatively. (When quantitative data are transformed in a way that they can be “qualitized” and qualitative data is converted to be “quantitized”, it is called a mixed-model research; Saunders et al, 2009).

A mixed method research is consistent with the adopted pragmatic philosophy of science as it goes beyond multi-method approaches, providing opportunities of mixing research choices at multiple levels (methods, methodologies, and paradigms) and producing insights that exceed the sum of the separate qualitative and quantitative components (Molina-Azorin et al., 2017).

In accordance with a pragmatist research philosophy, it is assumed that a plurality of methods is likely to be the most productive approach to address many of the big questions in public administration, including those involving attention and decision making processes (James et al., 2017). Based on the work of Bryman (2006) on the combination of quantitative and qualitative methods in the social sciences, there are at least three reasons for selecting the mixed methods approach for conducting this research. First, it contributes to triangulation; this is, the use of two or more independent sources of data and collection methods that together provide mutual confirmation of results and corroborate research findings within a study. Second, it also contributes to facilitation (also known in the literature as “development”; Molina-Azorin et al., 2017), which means that one data collection method or research strategy is used to aid research that employs another data collection method or research strategy within the same study. This is the

case of Study #1 (systematic review) that informs Study #2 (experimental design) by providing insights on the implications of conflictive definitions of a wicked problem, which are useful for developing hypotheses on issue framing, values and decision making. It also helps develop Study #3 by supporting the case study selection and the interpretation of findings according to the four wickedness dimensions identified in the systematic review. Third, a mixed-method design allows the study of different aspect of the same phenomenon by extending the breadth and range of inquiry through the use of different methods for different inquiry components (this is also known as “expansion”; Molina-Azorin et al., 2017).

In this last regard, the quantitative experimental method in Study #2 provides evidence about the micro-foundation of framing effects and values at individual level, which helps forming the theoretical underpinnings of an aggregate-level theory of attention. Study #3 further explains how the framing of a wicked problem influences conflict and the decision making process at an organizational level. In other words, the experiments provide rigorous evidence about micro-level causal processes behind the more macro-level or institutional/organizational phenomenon (James et al., 2017). Arguably, the use of different methods in a sequential way leads to greater confidence in my research findings and conclusions.

### **Time horizons (fifth onion’s layer)**

In line with a pragmatist research philosophy, this research conducts both a cross-sectional and a longitudinal investigation depending on the research questions to be answered. The qualitative systematic review and synthesis (Study #1) is based on empirical research on wicked problems published between 1972 and 2014. This is a cross-sectional study because the data collected is used to analyze many different wicked problems at the same point of time, without regard to differences in time when the research was published and/or the evolution and development of wicked problems over time. The experimental research and its accompanying questionnaire (Study #2) are also cross-sectional in the sense that through both research strategies I observe a particular phenomenon (framing effects on decisions involving wicked problems) at a particular moment in time.

The case study is based on interviews conducted over a short period of time; however, it is a longitudinal research as the analytical focus is on observing events over time and how the government attention process on wicked problems changes and develops in two cycles (1990-93 and 1994-98). Key sources of information for the case study are also official documents and newspaper articles published over the 1990 decade.

The chart below synthesizes the research choices presented in this section.

**Table 1.1. Research design**

Research Philosophy	Ontology	Epistemology	Axiology	Approaches	Strategies	Time Horizon	Method Choice
Pragmatism	Objectivistic	Positivistic	Value-free	Deduction	Experiment and Questionnaire (Study #2)	Cross sectional	Mixed-method research
		Critical Realist	Value-laden	Induction	QSR (Study #1)	Cross sectional	
					Case Study (Study #3)	Longitudinal	

Source: own

## Conclusions

This entire research is conducted from a reality-oriented perspective (Patton, 2002) with the purpose of generating and testing theory and establishing causalities on the implications of wicked problems on government decision making and attention processes. This means that, to a greater or lesser extent, the language and concepts of mainstream science (e.g., hypothesis, generalization, sampling, etc.) are used to design each of the three studies, to inform primary and secondary data gathering, to analyze and synthesize results, and to judge the quality of findings. The goal of incorporating scientific principles into qualitative analysis is to get as close as possible to what is really happening in the setting under examination by providing plausible explanations based on impartial and independent judgment, consistent and dependable data, and explainable inconsistencies and biases. From this stance, the validity (i.e., the degree to which the findings are interpreted in a correct way), reliability (i.e., the degree to which the findings are independent of accidental circumstances of the research process) and objectivity of

knowledge produced (i.e., a simultaneous realization of as much reliability and validity as possible) are important criteria to assess the quality of this research and to ensure the accuracy and credibility of my findings (Kirk and Miller, 1986).

Based on the pragmatic philosophy and critical realistic epistemology adopted, it is nevertheless accepted that a completely value-free inquiry is practically impossible and that my values and preconceptions may influence what I see, hear and record when collecting data. For this reason, as it is further argued in each of the three methodological chapters below, it is important to make potential biases and limitations of the research process explicit, to discuss their possible incidence in reporting findings, and to take steps to mitigate the influence of my personal values through rigorous methodological procedures. For instance, the systematic use of a computer aided qualitative data analysis software (CAQDAS) –i.e., NVivo 10– for conducting the systematic review (Study #1) improves the transparency and methodological rigour of the analytical procedure, especially regarding data management and organization, exploration, coding and retrieval of qualitative data, searching and interrogating data to build propositions and theorize, and recording thoughts systematically (Saunders et al., 2009). Similarly, Study #2 is conducted in a laboratory setting that allows greater control over aspects of the research process, such as sample selection and the context within which the experiments occurs, that improves the internal validity of the study. This research strategy contributes to an objective explanation of causal relationship between variables (i.e., framing conditions and decisions regarding wicked environmental problems) based on a highly structured methodology that facilitates study replication for reliability purposes, control over experimental conditions that allows the testing of hypotheses, and distance regarding what is being studied. Finally, theory building from the case study (Study #3) follows a replication logic (Eisenhardt and Graebner, 2007; Patton, 2002) that allows other researchers to audit and verify the rigour of the empirical work and the confirmability of the data collected by minimizing inaccuracies and biases.

In general terms, the triangulation of data sources and analytical perspectives and the use of a mixed methods research approach aim to provide better opportunities to answer the research questions, to evaluate the extent to which the research findings can be

trusted, and to enhance the credibility of inferences made from them (Tashakkori and Teddlie, 2003; Molina-Azorin et al., 2017).

## Chapter 2. Literature Review on Wicked Problems and Organizational Attention

This chapter surveys two separate bodies of literatures, the theory of wicked problems and meta-theories of organizational attention, with the goal of summarizing prior research in both fields and understanding where and how my own research fits into and adds to these existing bodies of agreed knowledge. Through this literature review I also aim to identify limitations of extant attention theories to be applied to the analysis of wicked problems given the nature of this particular type of societal issues. The insights coming out of this review will be used to structure data collection and analysis for the three studies presented in Chapter 1.

### An introduction to wicked problems

The first bibliographic record of wicked problems appeared in a C. West Churchman's editorial that *Management of Science* published in 1967, which documented a seminar where Horst Rittel introduced the term. In 1973, Rittel and his colleague Melvin Webber further developed a theory of wicked problems in a foundational paper entitled 'Dilemmas in a General Theory of Planning' that has received more than 3,950 citations on Web of Science as of September 2018.

Professor Rittel was recruited to Berkeley in 1963 to teach Science of Design; this is, theories and methods on the nature of design problems, the kinds and structures of knowledge the designers use, the formation of judgment, and their logics of procedure. He was one of many professionals disenchanted with the ineffectiveness and inadequacy of the 'system approach of the first generation' to solve practical and social problems that strategic planners, designers, managers, and corporate and community decision-makers have dealt with in real settings. The *system approach of the first generation* refers to the classical scientific-based analysis and linear protocols for professional practice built on the 19<sup>th</sup> Century view of science that emphasizes a rigorous and systematic problem-solving doctrine based on claims of rationality and objectivity (Rittel, 1972; Kunz and Rittel, 1972; Rittel and Webber, 1973). This approach is characterized by a mode of procedure and certain rational sequence of steps that Rittel considered inadequate to attack problems of open social systems, namely: (i) to understand and define the problem;

(ii) to gather information to understand its context from the viewpoint of the problem; (iii) to analyze the information; (iv) to generate solutions; (v) to assess the solutions and to decide to take the solution which comes out best; (vi) to implement the solution; (vii) to test it; and (viii) to modify the solution, if necessary, and learn for the next time (Rittel 1972: 391). This rational, lineal systemic approach to address societal problems has clearly permeated the highly influential work on rational-comprehensive and incremental models of policymaking (e.g., Bardach, 2009; Lindblom, 1984). As with the system approach of the first generation, such models try to incorporate all relevant and important aspects of the policy problem at hand into one measure of effectiveness intended to be maximized by the optimal allocation of resources (e.g., time, money, staff).

Rittel (1972) underscores two limitations of the system approach of the first generation to address practical societal problems. The first one is the naive concept of rational behaviour the system analysis is based on and its limited capacity to anticipate the consequences of contemplated actions in practical policymaking arenas. In line with other authors of the time (e.g., Peery, 1972; Thayer, 1972), Rittel criticizes the existence of “deep-lying paradoxes connected with the concept of rationality” (1972: 391) that make impossible to carry over in a successful way the ideals and principles of the scientific work into the context of professional and practical problems that could not be manipulated, simulated, reproduced in a controlled and ordered environment. His argument is based on the definition of rational behaviour as “trying to anticipate the consequences of contemplated actions” (1972: 391). Accordingly, the first paradox of rationality is that there is no way to start to be rational; therefore, one should always start a step earlier. “Before I can start to trace the consequences of my actions, I should trace the consequences of tracing consequences of my actions,” says Rittel (1972: 391). The second paradox is that, once an individual has managed to start being rational, there is no reason to stop tracing consequences because every consequence can be expected to have further ones. Thus, once the process of tracing consequences has been started, it cannot be stopped anymore; it only ends for extra-rational reasons (e.g., lack of time, money, etc.). The third paradox of rationality is that the more one succeeds in being rational -i.e., the further a person develops causal chains of consequences into the future-, the more the effects of uncertainty will come into play and the less one can derive from that what one

should do next. The last paradox is that of self-containment. This is, any model that provides a causal description of the consequences of contemplated actions influences what can be traced as a consequence; therefore, the model should contain itself, but that is impossible.

The second limitation of the system approach exposed by Rittel (1972) is the nature of social issues that decision makers usually face, which are considerably different from the problems that scientists and some classes of engineers deal with in a laboratory setting. In 1973, Rittel and Webber proposed a *theory of wicked problems* based on ten properties that distinguish the planning-type of problems that underlie modern professions from *tame problems* (see Table 2.1). The authors argue that, according to these characteristics, wicked problems are innately resistant to any linear formulations of scientific analysis and protocols for professional practice. Wicked problems defy the conventional approaches and skill sets of planning, management and policy-making, and their underlying traditional problem-solving strategies that can only provide partial ‘tame solutions’ while “the beast [*i.e., the problem*] is still as wicked as ever” (Churchman, 1967: B-142). It is worth noting that tame problems can also involve high stakes and may be complex and difficult to address, but there exist established methods and best practices to guide their resolution. Such problems are also subject to established expectations and/or accepted standards of performance. Examples of tame problems include: rerouting commercial air traffic due to storm conditions, the rupture of a water main, the development of a vaccine for smallpox, analyzing the chemical components of air pollution, among others.

**Table 2.1. Comparison between Wicked and Tame Problems**

<b>Wicked Problems (WP)</b>	<b>Tame Problems (TP)</b>
1. There is no definitive formulation of a WP. (The formulation of the WP <i>is</i> the problem!)	1. An exhaustive formulation of a TP can be stated containing all the information the problem-solver needs for understanding and solving the problem.
2. WP have no stopping rule.	2. TP have a definite stopping point at which the solution is reached. The task is completed when the problem is solved.
3. Solutions to WP are not true-or-false, but good-or-bad.	3. A solution to a TP can be objectively evaluated as true or false, successful or unsuccessful.

4. There is no immediate and no ultimate test of a solution to a WP.	4. It is possible to determine on the spot how good a solution-attempt has been. The test of a solution to a TP is entirely under the control of the few people who are involved and interested in the problem.
5. Every solution to a WP is a "one-shot operation." Because there is no opportunity to learn by trial-and-error, every attempt counts significantly.	5. A solution to a TP can be easily tried or abandoned. The problem-solver can try various runs without penalty.
6. WP do not have an enumerable (or an exhaustively describable) set of potential solutions, nor is there a well-described set of permissible operations that may be incorporated into the plan.	6. TP have a limited set of alternative solutions and rules, accounting for all situations that can occur.
7. Every wicked problem is essentially unique.	7. A TM has a correlation to a class of similar problems that can be solved in a similar way. There are scientifically based protocols that guide the choice of solutions.
8. Every WP can be considered to be a symptom of another problem.	8. The causes of a TP are determined primarily by experts using scientific data (e.g., clinical trials). The problem is associated with low uncertainty as to system components and outcomes.
9. The existence of a discrepancy representing a wicked problem can be explained in numerous ways. The choice of explanation determines the nature of the problem's resolution.	9. The clear definition of a TP also unveils the solution. There are rules and/or procedures to determine the "correct" explanation of a TP.
10. The problem-solvers have no right to be wrong and are liable for the consequences of the actions they generate.	10. Solutions to TP are only hypothesis offered for refutation. The scientific community does not blame its members for postulating hypotheses that are later refuted.

Source: own based on Rittel and Webber (1973), Kreuter et al. (2004), Borrone (2005), Batie (2008)

### Recent developments in the theory of wicked problems

Rittel's work on systems and methods of the second generation has become notoriously influential in design, information systems and computer sciences. He formed the basis of a line of research known as Design Rationale –to date, over 1000 papers have been written on this subject in those fields– and introduced the Issue-Based Information System (IBIS) as an early model of design rationale systems (Rith and Dubberly, 2006a). Over the years, Rittel and Webber's theory on wicked problems has also extended to diverse disciplines and research areas such as art (Buchanan, 1992), architecture (Coyne, 2005; Jarzombek, 2006; Roaf, Nicol and de Dear, 2013), business management (Gilmore and Camillus, 1996; Conklin, 2008; Camillus, 2008; Vo, Chae and Olson, 2007; Martin,

Gollan and Grigg, 2011; Andersson and Ullah, 2014), health care (Periyakoil, 2007; McLean, 2013; Hudson, Comer and Whichello, 2014; Jha and Lexa, 2014), education (Borko, Whitcomb and Liston, 2009; Hatchuel, Le Masson and Weil, 2011; Seager, Selinger and Wiek, 2012; Ryan and Neumann, 2013; Sadowski et al., 2013), physics (de Lira, 2010; de Lira, Velikovich, Wouchuk, 2011) and psychology (Munneke et al., 2007; Beacham and Shambaugh, 2010; Kazdin, 2011), to list just a few.

Although timidly, the arguments of Rittel and Webber (1973) have also gained acceptance in the field of public policy and administration, which resulted in further elaboration and sophistication of their theory. Their seminal theoretical proposition has evolved from a dichotomous categorization of problems (*wicked* versus *tame*) to the understanding of *wickedness* as a continuum (i.e., there are problems that are “more wicked” than others). Head (2010), for instance, defines wickedness in water governance as a combination of: complexity of elements and interdependencies, uncertainty in relation to risk and consequences of actions, and divergence in values and strategies, each having three possible values (low, moderate, and high). Likewise, Head and Alford (2008) present a typology of problems that goes from tame to wicked and to very wicked problems according to two dimensions: complexity (i.e., the degree of knowledge on problems and solutions) and diversity (i.e., amount of implicated stakeholders).

In a highly cited paper on the topic, Nancy Roberts (2000) proposes a typology of wicked problems based on the existence of conflicts over problems and solutions, power dispersion and power contestation. These characteristics, in turn, determine three possible coping strategies to deal with wicked problems: authoritative, collaborative and competitive strategies. Authoritative strategies seek to tame wicked problems by vesting the responsibility for solving a wicked problem in the hands of few stakeholders as a way to reduce its complexity by eliminating competing points of view at the start of the problem-solving process. The disadvantage of this strategy is that authorities and experts charged with solving the problem may not have an appreciation of all the perspectives needed to tackle the problem. Competitive strategies attempt to solve wicked problems by confronting opposing points of view and preferred solutions against each other. The advantage of this approach is that different solutions can be weighed up against each other and the best one chosen, whereas the disadvantage is that this adversarial approach

creates a confrontational environment in which knowledge sharing is discouraged and, therefore, the parties involved may not have an incentive to come up with their best possible solution. Collaborative strategies aim to engage all stakeholders in order to find the best possible solution for everyone involved by discussing issues and ideas, and formulating a common, agreed approach (Roberts, 2000).

Expanding upon Rittel and Webber concepts, the term *super wicked problem* has also recently been coined to describe major global challenges, such as climate change. Some of the exacerbating features that make climate change a super wicked problem are the fact that time to take action is running out, and that there is a lack of incentives to act in short timeframe and an absence of institutional frameworks of government that match the global scale and temporal scope of the problem. These are indeed significant obstacles both to the enactment of climate change legislation and to its successful implementation over time (Lazarus, 2010; Levin, Cashore, Bernstein and Auld, 2010; Hilson, 2013).

Other authors have used the distinctive characteristics of wicked problem to develop their own problem typology. For instance, R. Horn and R. Webber (2007) coined the term 'social mess' to depict a set of interrelated complex problems resistant to analysis and resolution. Social messes have fourteen defining features that share many commonalities with the original definition of wicked problems, namely: 1) no unique "correct" view of the problem; 2) different views of the problem and contradictory solutions; 3) most problems are connected to other problems; 4) data are often uncertain or missing; 5) multiple value conflicts; 6) ideological and cultural constraints; 7) political constraints; 8) economic constraints; 9) often a-logical or illogical or multi-valued thinking; 10) numerous possible intervention points; 11) consequences difficult to imagine; 12) considerable uncertainty, ambiguity; 13) great resistance to change; and, 14) problem solver(s) out of contact with the problems and potential solutions.

Horn and Webber (2007) advocate resolution mapping and mess mapping as powerful processes and analytic tools that can be applied to resolve wicked problems. Both are novel visualization methods that create information murals that facilitate seeing the big picture as well as needed detail surrounding a wicked problem. Such graphic representation of the knowledge architecture surrounding a wicked problem helps to: show large processes or larger contexts that form the background of public policy issues;

represent serious and complex debates; portray different cultures; represent multiple strategies; understand ideologies; get a more comprehensive picture of unknowns; and represent a variety of mindsets and worldviews (Horn, 2005). Similarly, J. Conklin (2006) proposes dialogue mapping, which is itself a development of Rittel's issue-based-information-system (IBIS), as a technique to build shared understanding of wicked problems in areas other than planning and policy by developing collective thinking and commitment to a negotiated action.

Overall, since the first 1973 set of characteristics, there have been several variants added to the original account of Rittel and Webber; however, they all seem agree on that wicked problems cannot be solved by the application of standard (or known) methods. Solutions to wicked problems need a combination of human cognitive abilities (creativity) and social abilities (teamwork), and the participation of multiple stakeholders, many with conflicting values.

### **Wicked Problems and other problem typologies**

Contemporary to the distinction between tame and wicked problems proposed by Rittel and Webber, the decade of 1970 witnessed the proliferation of a variety of other problem typologies to depict more complex and ambiguous issues, challenging the well-defined but unrealistic problems covered in traditional system theory, organizational design theory (e.g., Thompson, 1967; Galbraith, 1974) and in organizational economics (e.g., Williamson, 1975).

Robert Ackoff (1974), for instance, discussed the differences between *difficulty* and *mess*. The former is characterized by a broad agreement on the nature of the problem and by some understanding of what a solution would look like, and it is bounded in terms of the time and resources required for its resolution. The latter is defined by the lack of a clear agreement about exactly what the problem is, and by uncertainty and ambiguity as to how improvements might be made. A mess is unbounded in terms of the time and resources it could absorb, the scope of enquiry needed to understand and resolve it, and the number of people that may need to be involved. Using Ackoff words: "Every problem interacts with other problems and is therefore part of a set of interrelated problems, a system of problems [...] I choose to call such a system a *mess*" (1974: 21, emphasis in the original). Ackoff was an advocate of system thinking and, in particular, his form of

interactive planning as the best ways of coping with the messy complexities of interrelated real-world problems.

Another notorious classification is Simon's (1973) distinction between well- and ill-structured problems. His paper "The Structure of Ill-Structured Problems" is considered a strong defence of artificial intelligence (Simon, 1968) against the critique that certain problems are too ill-structured (or ill-defined) to be computationally solvable (Foss and Foss, 2005). According to Simon (1973), virtually all problems are, from the outset, best regarded as ill-structured problems. However, they can be transformed into well-structured problems through the process of being prepared for the problem solvers. In other words, well-structured problems are outcomes of problem-defining processes. Imposing structure on an ill-structured means choosing some way of decomposing the problem into sub-problems and choosing constraints (i.e., any or all of the elements that enter into a definition of a problem).

Well-structured problems share some or all of the following characteristics: 1) there is a definite criterion for testing any proposed solution (e.g., effectiveness or efficiency), and a mechanizable process for applying the criterion and evaluating the final proposed solution with respect to such criterion; 2) all transitions from one considerable state to another can be represented in a *problem space*; 3) any knowledge that the problem solver can acquire about the problem can be represented in one or more problem spaces; 4) there is at least one problem space in which all initial elements that enter into the solution of the problem are known and described (e.g., the initial problem state, the goal state, and all other states that may be reached or considered); 5) the way in which the problem is solved must completely reflect in one or more problem spaces the relevant laws of nature that govern the external world; 6) solving the problem requires only practicable amounts of computation and the relevant information that is needed to solve the problem can be gathered by means of practicable amounts of search. Any problem that does not meet all of these requirements is considered an ill-structured problem. The implication is that the distribution of problems between well-structured and entirely ill-structured (i.e., none of the above requirements are met) is a continuum (Foss and Foss, 2005).

Rittel and Webber's (1973) definition of wicked problems shares many common features with Ackoff's and Simon's typologies, especially regarding the complex

interrelationship between (sub)problems, the uncertainty about the outcome of proposed solutions, and the lack of agreement about the essence of the problem itself. It's worth acknowledging, however, that wicked problems are in some other aspect substantially different from these other types. For Simon, any ill-structured problems can be made structured through certain processes of transformation (decomposition into sub-problems), and that this renders them computable, solvable. For Ackoff, in order to deal with a system of messy problems and opportunities an essential skill of a systems practitioner is the ability to deal with it synthetically, as a whole. This is, contrary to wicked problems, it is assumed that the solution to messes and ill-structured problems resides within the boundaries of the rational behaviour and the system approach that Rittel and Webber (1973) highly criticize.

Rittel and Webber (1973) go a step further and propose that wicked problems can only be addressed by adopting a *system analysis of the second generation* (Rittel, 1972; Kunz and Rittel, 1972; Rittel and Webber, 1973). This alternative approach understands wicked-problem solving as a political argumentation process that leads to innovation rather than improvement. It is furthermore a multidisciplinary, deliberative, non-linear problem solving perspective that is not concerned with scientific factual knowledge (what-is) but with instrumental knowledge about actions (how what-is relates to what-ought-to-be); in other words, how actions can meet goals. The second generation approach needs ways to support and enhance the development and tracking of multiple arguments to make explicit, transparent and communicable the basis of judgment in any particular case (Rittel, 1972; Kunz and Rittel, 1972; Rittel and Webber, 1973; Rith and Dubberly, 2006a and 2006b; Churchman, Protzen and Webber, 2006). Wicked problems can be tamed only when a great number of people change their mindsets and behaviours, rather than using empirical science, mathematics, logic and algorithmic models or more/better rationality and system thinking.

### **A review of theories of organizational attention**

In organization studies, attention is not a unitary concept and it has produced disparate findings and a poor cumulative body of coherent work (Ocasio, 2011). In this section, I review different approaches to organizational attention, identifying the strengths, limitations and applications of their key concepts and theoretical models that will be later

used for purposes of theory refinement and analytical generalization of my empirical research findings. The following meta-theories are reviewed here:

- 1) The behavioural approach to organizational attention
- 2) Attention as part of managerial cognition
- 3) Issue selling
- 4) Ecological perspectives
- 5) Attention based view of the firm (ABV)

1) *The behavioural approach to organizational attention*. Starting with the work of the Nobel Prize laureate Herbert Simon in the mid-twentieth century, research conducted at the Carnegie School on information processing and decision making in organizations has been highly influential on the study of organizational behaviour, in general, and attention allocation, in particular. By applying insights from decision analysis, management science and psychology, the behavioural approach defines organizational attention as a scarce, selective, situation-based and structurally distributed cognitive resource. It has a central role to organizational behaviour that Simon (1947) describes as a complex network of attentional processes. Organizational attention determines how organizations process information and select alternatives, affecting both forward and backward search for information in order to solve organizational problems and acquire new knowledge (Cyert and March, 1963). A particular interest is put on how this cognitive process is affected by organizational sub-units (March and Simon, 1958), departmentalization (Dearborn and Simon, 1958) and attention structures (March and Olsen, 1976).

From this perspective, an organization is conceived of as an orderly pattern of attention-constrained action and search, where decision makers differ in their knowledge of alternatives and consequences (March and Simon, 1958). The limited attentional capability of individual decision makers results in their bounded capacity to be rational and inability to maximize preferences over the set of all conceived alternatives when dealing with real-life decision problems (Simon, 1947 and 1955). Yaniv and Schwartz (2011) indicate that bounded rationality of the individual is parallel in many ways to organizational attention in the sense that it is based on the limited ability of decision makers to pay attention to all aspects of the problems they deal with. Individual bounded rationality in fact makes time and attention scarce resources in organizational problem-

solving processes (Foss and Foss, 2005). The argument for attention scarcity is well known. As James March notes (1994: 10): “Time and capabilities for attention are limited. Not everything can be attended at once. Too many signals are received. Too many things are relevant to a decision, because of these limitations, theories of decision making are often better described as theories of attention or search than as theory of choice. They are concerned with the way in which scarce attention is allocated.”

Building on the influential work of Cyert and March (1963) on the behavioural theory of the firm, research on organizational attention coming from this current of thought puts a strong emphasis on decision making and sequential attention to multiple organizational goals. Cyert and March (1963) conceive of organizations as problem-solving entities with limited attentional capacity, multiple competing goals and quasi-resolution of conflict, and competing attentional perspectives among units and members of the firm’s political coalition. Attention is seen as a top-down cognitive process mostly driven by goals (March and Simon 1958; Cyert and March 1963; Greve, 2008), which affects both automatic and intentional information processing and generates heightened awareness and focus over time to relevant stimuli and responses (Ocasio, 2011). In this meta-theory, *sequential attention* means that high performance on one goal shifts attention toward the next, making organizations pursue one goal at a time (Greve, 2008). Organizational responses to goals thus differ depending on whether other goals are met or not. A goal consists of an *aspiration level* on a measurable organizational outcome (‘the goal variable’), and the realized outcome on a goal variable is often called ‘performance’. An aspiration level is “the smallest outcome that would be deemed satisfactory by the decision maker” (Schneider, 1992: 1053 cited by Greve, 2008).

An important proposition coming from this approach is that attention is necessarily selective for two reasons: because decision makers decide to focus on a part of a stimulus while deliberately ignoring the remainder as irrelevant to their goals and motives, or because it is an internalized learned response stemming from some past history and organizational experience with existing decision and attentional rules (Dearborn and Simon 1958). Such internalization of attention selection is important for the study of attention on wicked problems. It means that when a decision maker is presented with a complex stimulus, the subject perceives in it what she is ready to perceive, and “the more

complex or ambiguous the stimulus, the more the perception is determined by what is already "in" the subject and the less by what is in the stimulus" (Dearborn and Simon, 1958: 140). Dearborn and Simon (1958) provide empirical evidence that the departmental affiliation of top executive decision makers (e.g., sales, production, accounting, etc.) and those aspects of a situation that relate specifically to the activities and goals of their own departments are key determinants of attentional selection.

Hence, attentional selection can be understood as the pattern of outcomes that results from sequential attention to alternative aspiration levels in response to changes in performance (Greve 2008). When decision makers fail to meet aspiration levels, local "problemistic search" (Cyert and March 1963), organizational learning and attentional rules are triggered. In other words, when an organization falls below the aspiration level of a goal variable, decision makers initiate problemistic search for actions (i.e., the pursuit on the part of an organization of a solution, stimulated by a particular problem) that may produce outcomes above the aspiration level. Thus, aspiration levels affect organizational decision making through adjustment of problemistic search and acceptance of risk (March and Shapira, 1992; Greve, 2008). Risk taking, in turn, is affected by 'slack resources' (i.e., resources in excess of current aspirations): when slack is plentiful, it leads to relatively high levels of risk taking such as relaxation of controls, reduced fears of failure, institutionalized innovation, increased experimentation; but when slack is small, it produces relatively low levels of risk taking. Slack resources can lead decision makers to focus attention relatively more on the advantages rather than on the dangers of a risky decision (March and Shapira, 1992).

Another important proposition for the analysis of attention in public organizations that serve a variety of constituency groups –each with different interests, goals and values– comes out of the behavioural approach to attention. Cyert and March (1963) argue that decision makers seek to meet aspiration levels on a broad range of goals to avoid struggle among constituencies with potentially conflicting goals. Sequential attention is then a form of quasi-resolution of conflict that lets decision makers treat different goals as constraints to be satisfied in some order of priority rather than as trade-offs that have to be weighed against each other (Greve, 2008). Sequential attention reduces cognitive effort and political strife, but it could also yield suboptimal, organizational decision

making (Greve, 2008). The order in which goals are attended to is not uniform among organizations and over time but may differ according to the preferences of the “dominant coalition” of each organization (Cyert and March, 1963). The challenge for decision makers is to anticipate which issues are likely to be relevant, given that “[o]rganizations learn to pay attention to some parts or their comparative environment, and to ignore other parts” (Cyert and March, 1963: 123).

2) *Organizational attention as part of managerial cognition.* This meta-theory views organizations as interpretation systems that have mechanisms to make sense of ambiguous events and stimuli, and to provide meaning and direction for their members (Daft and Weick, 1984). This is based on the assumption that organizations are open social system that process uncertain and ambiguous inputs from the environment through information processing mechanisms capable of detecting stimuli that are relevant to organizational survival. From this point of view, *organizational interpretation* is the process through which information is given meaning and actions are chosen by a relatively small group at the top of the organizational hierarchy. Organizational interpretation can be defined as “the process of translating events and developing shared understanding and conceptual schemes among members of upper management” (Daft and Weick 1984: 286). The interpretation system view is concerned with specialized information reception, equivocality reduction and sensemaking (Weick, 1995), rather than goals and decision making, as central to organizations and organizing (i.e., a set of activities directed toward “the resolving of equivocality in an enacted environment [...and] the establishment of a workable level of certainty”; Weick, 1969:91). According to Daft and Weick (1984), almost every organizational activity or outcome is in some way contingent on interpretation. Changes in interpretation are seen as changes in the focus of organizational attention (Ocasio, 2011).

Research from a managerial cognition perspective has been mainly focused on explaining how selective attention to environmental stimuli shapes strategic adaptation. Although authors following this approach recognize that attention is limited and scarce, as the behavioural approach argues, the analysis is directed to the quality of attention, not its quantity (Weick and Sutcliffe, 2006), to information overload as a problem of action, interpretation and sensemaking rather than as a problem of computation and information

processing (Sutcliffe and Weick, 2008), and to the relationship between organizational attention and organizational learning (Levinthal and Rerup, 2006; Rerup, 2009; Yaniv and Schwartz, 2011).

Critical for this perspective is the idea of *mindfulness* developed in the psychological literature. Levinthal and Rerup (2006) define this concept as attentiveness to context and the capacity to respond to unanticipated cues or signals by encoding ambiguous outcomes in ways that influence learning and by encoding stimuli in ways that match context with a repertoire of routines. Levinthal and Rerup (2006) distinguish mindful (or controlled) information processing from less mindful (or automatic) information processing, arguing that the latter involves fewer cognitive process and greater reliance on previous learned routines. According to these authors, routine-driven behaviour has many benefits for organizations, including conserving attention and capturing knowledge accumulated from previous experience in the organization. Weick and Sutcliffe (2006), however, propose an alternative view of attentional mindfulness in terms of the “quality” of organizational attention, away from encoding and conceptual thinking, and toward concentration and stability of attention. Weick and Sutcliffe (2006) suggest that limits to attentional quantity or capacity can be overcome with attentional stability. In their own words, “when people move away from conceptuality and encoding, outcomes are affected more by the quality than by the quantity of attention” (Weick and Sutcliffe, 2006: 514).

In this sense, mindfulness is about the qualities of attention such as its focus, stability, sustainability and vividness, which help reducing distraction and holding an intended object in mind. Mindful attention can thus be described as scattered or stable and vivid or lax: to be ‘more mindful’, for example, means to attend with both greater stability and greater vividness. Weick and Sutcliffe (2006) define attention stability as the percentage of ascertaining moments that are directed at the intended object rather than at some other object. The greater the proportion of ascertaining moments that are focused on the intended object rather than on other objects, the greater the homogeneity of those ascertaining moments, and the more stable the attention. Attention vividness is defined by the ratio of ascertaining to non-ascertaining moments; if this ratio increases so too does the vividness of the intended object.

Based on an empirical case study, Rerup (2009) has suggested, however, that attentional stability and vividness are insufficient for organizations to learn from weak signals. This author developed the concept of *attentional triangulation* to refer to the intersection of three interdependent dimensions of organizational attention (stability, vividness, and coherence) as a way to identify issues that have the potential of having critical consequences for the organization and prevent a crisis from (re)occurring. Rerup notes that each dimension of attention produces incomplete identification of weak cues, but their triangulation allows organizations to increase the speed and accuracy in identifying issues that are potentially relevant. Building on the work of Weick and Sutcliffe (2006), Rerup (2009) defines attention stability as sustained attention to issues (focalization and concentration of consciousness are critical in this regard), and attention vividness as the complexity of representation of issues through the development of categories for noticing and classifying issues and stimuli (diffusion and diversion of consciousness to peripheral issues are thus essential). Attentional coherence describes how similar or compatible attention to issues is across the organization, denoting the deliberate involvement of multiple organizational members, teams, departments, and hierarchical levels in scanning, sharing, and interpreting information.

The concept of attention triangulation addresses under-theorized elements of organizational learning (Levinthal and Rerup 2006, Weick and Sutcliffe 2006) and emphasizes the value of developing organizational designs (e.g., routines, structures and processes) to deliberately coordinate collective attention. The goal of attention triangulation is to reduce attentional fragmentation and confusion by both dividing and integrating the attention focus of their decision makers to more clearly discriminate between issues and detect emerging problems (Rerup, 2009). The dual need for differentiation and integration of organizational attention unfolds around the three aforementioned dimensions: stability, vividness, and coherence. Together they can potentially increase the quality of attentional triangulation through multiple and relatively independent attempts to discover and understand the same issues with greater clarity and depth. It is argued that by increasing the quality with which people attend to weak cues managers can potentially enable decision makers to prevent rare events in the future (Rerup, 2009). Attentional triangulation can help organizations to focus on weak cues

that come from lower levels in the chain of command, not only from the top of the organizational hierarchy.

The interaction of top-down and bottom-up attentional processes is thus explicit in the Rerup (2009) analysis of attentional triangulation. But it is also implicitly present in the Weick and Sutcliffe's (2006) concept of the quality of organizational attention, as well as in the Sutcliffe and Weick's (2008) definition of attention overload as an organizational phenomenon influenced by experience (i.e., novices and advanced beginners are more prone to miss or intentionally ignore more clues). Such top-down and bottom-up interaction suggests that organizational attention is not just a structural, monolithic phenomenon that can be stabilized and controlled by top executives, but a dynamic, disperse and evolving process that requires constant rebuilding, vigour, and persistence, supported by organizational designs that intentionally modify what various hierarchical levels do when they attend to contextual issues.

3) *Issue selling* is the process by which individuals affect others' attention to and understanding of the events, developments, and trends that have implications for organizational performance and change processes (Dutton and Ashford, 1993; Dutton et al., 2001). The analytical focus is mainly put on the strategic agenda building process in organizations; this is, why some issues get attention and others do not, and how structures, processes and individuals interact to create the set of issues that consume collective attention in organizations

Building on key propositions of the two meta-theories previously described, the issue selling perspective assumes that senior management attention is a scarce resource (Simon, 1947; Cyert and March, 1963; March and Shapira, 1992; March, 1994) and that attention to strategic issues is the first step in the interpretive process through which action-initiatives are launched (Daft and Weick, 1984). From an attention perspective, the issue selling meta-theory focuses on attentional selection, explaining whether and how middle managers and other organizational actors compete for managerial attention at the top of the organizational hierarchy.

Dutton (1986), for instance, develops a model of strategic agenda building describing the conditions under which strategic issues are likely to receive collective organizational attention, conceived as the allocation of information processing capacity and resources to

an issue (Simon, 1971). The model depicts how the issue and organizational contexts determine the issues that reach the agenda, defined as “a structure that limits and orders an array of issues for top level decision makers in organizations” (Dutton, 1986: 6). In this regard, attention allocation to strategic issues is conceptualized as an agenda building process through which strategic issues gain decision makers’ attention and are legitimated in the organization (i.e., the strategic agenda). The model proposes that the probability that any particular issue will be placed on the strategic agenda depends on the combination of three factors at any one point in time: the perceived attributes of an issue (Issue Salience), the political foundation of an issue (Issue Sponsorship), and the size and variety of items already on the issue agenda (Agenda Structure) that moderate whether or not these factors translate into awareness and interest in the issue.

Dutton (1986: 4) uses the term *agenda building* instead of *agenda setting* to highlight that “the agenda is not dictated by top level decision makers. Instead, the agenda is the product of forces at multiple levels of the organization that consciously or subconsciously work to make an issue consensual, legitimate and resource consuming.” The issue selling view departs from previous approaches to organizational attention through its recognition that some issues are more socially acceptable to attend to than others, that there are legitimacy forces –such as norms and beliefs– which constrain attention allocation to some issues, and that there exists an interdependence between attentional events. This means that the inclusion of any strategic issue on the agenda is affected by the set of issues already under consideration. Together these three theoretical contributions pave the way for a distinctive and more encompassing view of attention allocation to strategic issues as a social, political and psychological process (Dutton, 1986).

By combining insights from organizational management, psychology and sociology, Dutton and Ashford (1993) further developed a theoretical framework for explaining issue selling and issue-selling moves. They identified four general categories of issue-selling moves: packaging (i.e., the content framing of an issue), presentation of the issue (i.e., terms used to frame the issue), the type of appeal (e.g., one- or two-sided arguments), and bundling (i.e., sellers' attempts to connect the issue to other issues or goals in order to enhance the chances of gaining attention). Dutton and Ashford (1993) stated that ‘issue sellers’ (i.e., actors below or outside organizations' top management

groups) would be more successful to the extent that they told their stories succinctly, used emotional and novel terms, used two-sided arguments, and framed them so that top management felt a heightened sense of responsibility for actions. They suggested that sellers' success is also dependent on the extent that they sold their issues as strategically important, that the managements of their organizations were capable of responding, and that there were payoffs for the organizations.

In 2001, Dutton and her colleagues tested these arguments in an empirical case study of a regional hospital, which involved data collection from more than 2600 employees. They found some support for the moves identified by Dutton and Ashford (1993) and uncovered two additional moves (i.e., preparation and timing) that sellers make implicitly or explicitly when promoting an issue. Preparation involves a range of activities through which sellers learned about an issue and any attached solutions, and the context of the issue before and during the issue-selling process. Timing refers to persistence, opportunism and involving others at the right time as factors contributing to success in issue selling. In general terms, Dutton et al. (2001) found that the process of issue selling looks much more political and contextually embedded than it was portrayed as being in Dutton and Ashford's (1993) original account. Dutton et al. (2001) show that issue selling is a political and commitment-building process that require issue sellers to have in-depth knowledge of "how the system works" in order to effectively make change happen. The effectiveness of issue selling moves thus depends on sellers having a deep and broad knowledge about "the relational, normative and strategic context"; this is, knowledge about how to proceed, and how and when to involve others in the process in order to tailor issue-selling efforts to what best fits a particular organizational setting (Dutton et al., 2001).

Viewed through this lens, agenda building is an important mechanism of organizational adaptation to contextual change (Dutton, 1997). An issue's entry to the agenda is the first step in the initiation of issue-related action, indicating the beginning of the decision making process by activating and directing top management's attention to issues emanating from the organization's internal and external environments. Thus, by understanding how issues gain attention in organizations, new insights emerge from this perspective about organizational change as a bottom-up process; more specifically, about

the role of people below or outside organizations' top management team as initiators of change, the characterization of change as continuous rather than episodic, and the intersection of micro (psychological) and macro (social) forces in determining change patterns in organizations (Dutton, 1986; Dutton et al., 2001).

In a nutshell, this meta-theory makes five propositions that are important for understanding the relationship between collective attention and the agenda building process: 1) individuals are motivated to direct and shape the attention of top management toward some issues and not others; 2) agenda building is a 'social influence process' through which one set of individuals (e.g., middle managers) try to shape the thoughts, feelings, and understandings of others (i.e., top managers); 3) strategic issues are ambiguous and contested –rather than pre-packaged, bound and limited–, and their meanings are actively made and formed in a social context through processes of social interaction; 4) the ambiguity of strategic issues implies that language and issue labels (i.e., 'framing') are important for drawing attention to or away from an issue, resulting in different patterns of attention allocation; 5) timing is important to affect the strategic issue agenda by understanding and making sense of the moments when the top management team is pressed for action or when the occurrence of external triggering events (e.g., a crisis) translate into an openness to new agenda items (Dutton, 1997).

4) *Ecological perspectives* refers to the study of the competitive nature of attention between different targets seeking the attention of organizational actors and field-level actors. It proposes a bottom-up approach to attention driven by the characteristics of attentional and alternative targets (e.g., crowding, visibility, quality, urgency, salience). The ecological perspective is built on studies of the Carnegie School that argue that organizational attention is a valuable and scarce resource in organizations, that decision makers have limited attention capacity and, consequently, organizations do not attend to problems indiscriminately (Simon, 1957; March and Simon, 1958; Cyert and March, 1963, etc.). A logical consequence of these assumptions is that problems have to compete for the limited attention of decision makers. The ecological perspective tries to address at least two limitations of the behavioural approach to organizational attention: first, a lack of theoretical and empirical examination of the context through which attention competition occurs; second, a lack of detailed investigation about different attention

allocation mechanisms constrained by the context's surrounding problems and solutions. Ecological perspectives thus contribute to a deeper understanding of allocation of attention as an important mechanism through which organizations evolve to reflect changes in their operating environment.

Sullivan (2010), for instance, empirically examines the contextual influences of problems on organizational attention allocation based on a case study of the US Federal Aviation Administration (FAA), a context where an organization faces problems and searches for and generates solutions in the form of rules. In this case, the FAA's attention capacity is indicated by the number of employees involved in the rulemaking process that is divided in two main stages: rule proposing and rule finalizing. Sullivan suggests that competition for attention can be guided by different attention allocation rules. At the rule proposal stage, different types of problems compete for attention when the organization searches for solutions directly linked to problems. At the rule finalization stage, attention is guided by "urgency" induced by new problems that flow into the organization at the same time that it has to solve old problems.

According to the results of a series of regression analyses, Sullivan demonstrate that a public organization could be pushed to take action because of the general sense of urgency (i.e., the "urgency effect") generated by new problems that create a sense of pressure compelling an organization to attend to certain old issues within a constrained time period. Urgency induced by problems, however, can lead the organization further to favour "easier" solutions, increasing the difference in attention paid to easier and harder solutions: easier (or less complex) solutions would be given relatively more attention (Sullivan, 2010).

Hansen and Haas (2001) further explore the role of context in determining attention allocation and propose a data-driven, bottom-up attention process. These authors analyze how suppliers of electronic information compete for attention in a firm's internal knowledge market. Because attention is scarce, organization subunits that wish to disseminate their information are likely to compete for this resource. Hansen and Haas show that document suppliers that occupy a crowded segment of such market gain less attention from employees (measured as monthly use of their database). However, **is it** possible for suppliers to combat this negative competitive effect by being selective and

concentrated in their document supply: this is, the less information a supplier offered, the more it was used because the supplier develops a reputation for quality and focus. Hansen and Haas argue that through a process of social learning, users form and share opinions about different suppliers and create a social context that affects patterns of knowledge dissemination and information use in the organization.

This ecological model proposes a relational view in which both suppliers and users are considered, not only the supply-side. In this broader conceptualization of an internal knowledge market, users' social constructions and patterns of information demand also affect competitive dynamics (Hansen and Haas, 2001). The results of their regression analyses provide support to their two hypotheses: 1) in crowded segments of the internal knowledge market (i.e., where there is a greater overlap among suppliers), the more selective and concentrated an electronic document supplier, the more attention allocated to that supplier's documents; 2) in uncrowded niches, the less selective and concentrated an electronic document supplier, the more attention allocated to that supplier's documents. In a nutshell, this means that in an internal knowledge market users form perceptions about suppliers based on their publishing strategies and suppliers compete for the limited attention of users. The outcome of this contest determines what knowledge gets disseminated in an organization.

In another quantitative study that examines how foreign subsidiaries compete for the attention of corporate headquarters, Bouquet and Birkinshaw (2008) found that: attention decisions are partially based on the structural positions that subsidiary units occupy within a corporate system (i.e., their "weight"); a subsidiary has a "voice" of its own that it can use to attract attention; and the relationship between a subsidiary's voice and headquarters attention is moderated by two specific aspects of the subsidiary's historical situation, geographic distance and downstream competence. This study shows some similarities with the relational perspective proposed by the issue-selling literature on how individual players within an organization can access or get around its formal structures to more effectively capture the attention of executives at the top of the organizational hierarchy (Dutton, 1997; Dutton and Ashford, 1993). According to Bouquet and Birkinshaw (2008), however, the factors shaping organizational unit attention may be somewhat different from those observed in the issue-selling literature as they involve a

combination of individual initiative and aspects of a unit's historical situation. In this model, organizational subunits serve as carriers of attention to corporate headquarters and to the organization more generally, making headquarters attention the outcome of a bottom-up process.

5) *Attention based view of the firm* [ABV]. In the mid-90s William Ocasio, Distinguished Professor of Management and Organizations at the Kellogg School of Management, developed a framework for an attention-based view of the firm that combines insights from a variety of prior meta-theories, including Simon (1947) and March and Olsen (1976) behavioural approach, enactment processes (Weick, 1979), and issue selling and agenda management (Dutton and Ashford 1993, Dutton et al. 2001). From this point of view, attention in an organizational context is defined as “the noticing, encoding, interpreting, and focusing of time and effort by organizational decision-makers on both (a) issues: the available repertoire of categories for making sense of the environment: problems, opportunities, and threats; and (b) answers: the available repertoire of action alternatives: proposals, routines, projects, programs, and procedures” (Ocasio 1997: 189).

Building on attentional perspectives previously described, the arguments of the ABV approach are based on the following presumptions: the environment of decisions surrounding an organization is of infinite complexity and firms are bounded in their capacity to attend to all (or even most) environmental stimuli; attention is a scarce resource and attention allocation is inherently competitive; decision makers are selective in those aspects of the environment of decisions that they attend to; and organizational attention capacity is varied as a function of organizational decision structure (Ocasio, 1997; Sullivan, 2010; Yaniv and Schwartz, 2011). Similar to Simon's (1947) concept of decision premises and Weick's (1979) idea of enacted environments that refer to how organizational decision-makers encode and process contextual information, encoding becomes a central part of organizational attention in the ABV perspective. However, in contrast to the behavioural meta-theory of attention that focuses on how organizations structure the attention of individual decision makers as a source of control of individuals and organizational subunits (e.g., Simon, 1947), the ABV approach is mostly focused on how attention in organizations shapes organizational adaptation to changing

environments. Similarly to the issue selling view, ABV sees the organization as more than the senior management and focuses on organizations as systems of distributed attentional processing.

ABV proposes three principles of attention that, operating at different but interrelated levels, determine how firms distribute and regulate the attention of its decision makers: (1) the principle of focus of attention, (2) the principle of situated attention, and (3) the principle of structural distribution of attention. The first premise operates at the level of individual cognition; it means that what decision-makers do depends on what issues and answers they focus their attention on. Situated attention, at the level of social cognition, means that the issues and answers decision-makers focus on, and what they do, depend on the particular context or situation they find themselves in. At the organizational level, the structural distribution of attention means that the particular context or situation decision makers find themselves in, and how they attend to it, depends on how the firm's rules, resources and social relationships regulate and control the distribution and allocation of issues, answers, and decision-makers into specific activities, communications, and procedures (Ocasio, 1997).

As noted above, ABV defines attention as a process involving application of time, energy, and effort of individual decision makers. But organizational attention is also viewed as creating a socially structured pattern that becomes the firm's strategy. Ocasio's model makes at least two significant contributions to the understanding of how organizations and their structures channel and distribute the attention of their decision-makers. First, it highlights the importance of procedural and communication channels that situate the attention of decision-makers and contribute to the variations in attentional processing and the enactment of the environment. Second, under the concept of attentional processing, the model brings together a wide variety of cultural, social, cognitive, and economic mechanisms, at multiple levels of analysis, that shape how firms behave and adapt to changing environments.

More recently, ABV-inspired research has changed its analytical focus from factors affecting individual decision makers in organizational settings (Ocasio, 1997) to the structural determinants and distribution of attention at meso- and macro-levels of analysis. For instance, based on a longitudinal case study of General Electric from 1940

to 2006, Ocasio and Joseph (2008) examine how strategic planning processes –i.e., a system of strategy formulation, decision making and control– channel the attention of organizational decision makers throughout the firm. Nigam and Ocasio (2010) analyze President Clinton’s health-care reform in the early 90s to examine how attentional engagement generates sensemaking activities at the level of the organizational field. Hoffman and Ocasio (2001), at the industry level of attention, study how public attention on critical events triggers institutional transformation and industry evolution.

At the level of the organization, Ocasio and Joseph (2008) examine how attentional engagement –a form of cognitive search, leading to potential variation in established patterns of attention, cognition, and sensemaking (Ocasio, 2011)– is differentially distributed in the organization’s communication channels. They suggest that commonalities in attention and sensemaking across channels are required for new strategies to become part of the firm’s top-down cognitive and motivational structures that generate heightened awareness and focus over time to relevant stimuli and response. The authors demonstrate that specialized governance channels for decision-making and communications focus attention of corporate executives on distinct, yet critical, planning tasks to shape the corporate agenda. They argue that newly created and existing governance channels need to be tightly coupled “to ensure that the decision making system remains coherent and that critical issues and initiatives remain the focus of attention throughout the system” (Ocasio and Joseph, 2008: 270). The historic analysis of General Electric reveals that strategic planning practices can effectively be a responsibility shared between both corporate executives and operating unit managers – rather than the exclusive responsibility of corporate headquarters– if decision-making channels that integrate participants from different organizational levels are consequential to achieving collective engagement in strategic planning activities. Accordingly, Ocasio and Joseph (2008) conclude that information and communications flows across channels are just as important, if not more, than the formal reporting relationships in the organizational chart.

Nigam and Ocasio (2010) focus their analysis on the emergence and change of institutional logics that guide competition, cooperation, and coordination between diverse institutional actors at the organizational field-level. This work aims to explain the

mechanisms by which attention to events leads to institutional change; more specifically, how cognitive effects of attention to event and sensemaking may directly affect the emergence of new dominant institutional logics. The term institutional logic refers to the socially constructed principles for institutionalized practices in social systems and actors, such as the family, the market, religion, and the professions.

Nigam and Ocasio (2010) conducted an inductive case study of a critical event that received significant public attention, but which led to no direct legislation or regulatory change: President Clinton's healthcare reform initiative in 1993-94. Based on this case study, the authors developed a process model that proposes that environmental sensemaking occurs through two distinct but interrelated processes: theorization and representation. The former refers to the elaboration of abstract models of organizing structures and practices in the organizational field, whereas the latter indicates the use of specific exemplars or attention to specific field features to illustrate structures and practices in the organizational field. The authors propose that a new logic emerges through the interplay between ongoing attention, theorization, and representation over the event life course.

At the heart of this model is the idea that event attention (i.e., the coverage social issues receive within public arenas or organized channels of communication) can shape actors' cognitive beliefs by providing opportunities for sensemaking of both the event itself and of the broader field. According to this model, event attention influences environmental sensemaking through event salience that is driven by prior knowledge and expectations, goal relevance, novelty, and distinctiveness. The salience of specific features and occurrences over the event life course generates a bottom-up influence on environmental sensemaking, where features of the event have direct influence on how environments are first represented and subsequently theorized (Nigam and Ocasio, 2010).

Public attention to events and event salience are also discussed by Hoffman and Ocasio (2001) as a precursor to field-level change but at the industry level of analysis. The authors show that critical events –i.e., “contextually dramatic happenings that focus sustained public attention and invite the collective definition or redefinition of social problems” (p. 414)– are made salient and attract industry-level attention when there is contestation with outsiders over the industry's accountability for the event and its

enactment, and internal contradictions and challenges to the industry's identity. The concept industry-level attention introduced by these authors indicates how industry participants (e.g., producer organizations, industry associations, trade journals, and other members of the industry's field) in their communications and interactions with other industry participants, selectively focus their attention on a limited set of issues, situations and activities that represent potential problems or opportunities for the industry.

Drawing on a paired case comparison of media coverage of eight non-routine events affecting the natural environment and the U.S. chemical industry, Hoffman and Ocasio (2001) observed that the more contested the varying interpretations of meaning, the more sustained the levels of attention, and, in turn, the greater likelihood an event will emerge as an issue for an industry. This study supports the ABV proposition that selective attention to events is not shaped only by the objective characteristics of an event, but by its enactment. Thus, it helps explain why not all events are attended equally, and why some events become the critical focus of attention while other events remain mostly unnoticed. According to this view, two constructs trigger industry attentional processes to external events: 1) outsiders' attributions of the industry's accountability for the event (i.e., attributions for the causes of events holding particular individuals, groups, firms, industries, or sectors accountable for their occurrence); 2) industry's internal examination of the threat posed by the event to the image of the industry. This means that industries are more likely to attend to an event when they are held publicly accountable for that event, thereby affecting the industry's reputation; or when industry insiders conduct a self-examination of how the event may affect their image. The incidence of both factors (attributions for causes of events and challenges to the identities of key actors) has been also confirmed by Hoffman and Devereaux-Jennings (2011) in a case study on the BP oil spill, the largest accidental spill in history.

Also analyzing industry attention patterns, Cho and Hambrick (2006) and Abebe (2012) have extended the ABV perspective to the role of top management teams (TMTs) in shifting managerial attention and changes in industry's strategies following an environmental change. Observing the deregulation of the airline industry in the US between 1973 and 1986, Cho and Hambrick (2006) found that changes in TMT composition are associated with attentional change –i.e., what is noticed and attended to–

that, in turn, affect strategies to respond to a shift in the environment (in this case, the deregulation of the industry). According to this study, different managers arrive at different strategies because, in part, they differ in how they notice and interpret the stimuli around them. Managers differ in their attention –where they look, what they notice, the weights they give to contradictory stimuli, and the interpretations they attach (Ocasio 1997)– and these attentional differences are reflected in strategic differences. Abebe (2012) draws from the ABV arguments to examine the relationship among attention patterns of the upper-echelons, industry dynamism and corporate turnaround performance in declining firms. The author argues that declining firms operating in dynamic industry environments tend to improve their turnaround performance when executives focus their attention more on market-related sectors (i.e. customer, competitor and technological sectors). In contrast, disproportionate focus on input-related sectors of the task environment (i.e. suppliers and creditors) seems to adversely affect corporate turnaround performance. Abebe suggests that due to information-processing limitations, top executives emphasize on particular sectors of the external environment and their selective attention patterns influence the extent of corporate turnaround performance under varying environmental contexts. The findings of both studies are consistent with previous research that observed performance differences among organizations with differing top executive’s selective attention, but in a more dynamic, changing context that put at risk organizational survival and recovery.

### **Attention theories and the policy cycle**

The reviewed meta-theories of attention have had an important influence on research about organizational effects on political decision making and public administration. The study of attention pattern of policy makers and the generation of agendas and alternatives has indeed gained substantial momentum since the mid-1980s, becoming a central part of scholarship in public policy (Argote and Greve, 2007; Pump, 2011; Howlett, McConnell and Perl, 2014).

John Kingdon (1984), author of the landmark book *Agendas, Alternatives, and Public Policies*, acknowledges the influence of the work of Cohen, March and Olsen (1972) and March and Olsen (1979) on his model of policy agenda formation. Kingdon suggests that issues become prominent on policy agendas when three *policy streams* confluence. These

are: (1) the problem stream that refers essentially to policy problems in society that potentially require attention; (2) the policy stream that pertains to the many potential policy solutions that originate with communities of policy makers, experts and lobby groups; and (2) the politics stream that refers to factors such as changes in government, legislative turnover and fluctuations in public opinion. The streams are largely independent of each other until circumstances –such as a crisis often manifested in a dramatic focusing event– lead them to a confluence, producing at the agenda-setting stage *open windows* of opportunity for policy entrepreneurs to seek policy change. The metaphor of policy windows to capture future prospects at the agenda stage is inspired by the concept of *choice opportunities* that in the garbage can model of organizational choice proposed by Cohen et al. (1972: 3) refers to “occasions when an organization is expected to produce behavior that can be called a decision.” When there is a choice opportunity, collective energies are marshalled at specific points in time in the expectation that a decision will be taken and then appropriate action will be pursued.

Kingdon’s policy streams model has been subject to criticism for being principally focused on agenda-setting (not subsequent stages of the policy process), for its emphasis on contingency and chance, and for over-emphasising the importance of problem construction at the agenda stage despite the fact that the problem may be reframed or even abandoned in the long term (Howlett et al., 2014). It is not clear how Kingdon’s three streams would interact in response to a choice opportunity that occurs beyond the agenda setting stage. More elaborated models of agenda setting inspired by Kingdon (1984), such as the one proposed by Zahariadis (2007), retain the analytical appeal of explaining agenda-setting but recognize that new process streams (e.g., advancing a problem through discussion and implementation of a solution) come into being after an item is on the agenda.

Kingdon’s work on agenda setting has contributed to the development of what is known as punctuated equilibrium theory, an “evolutionary” policy approach that seeks to explain how and why particular environments operate to help produce specific kinds of policy change and stability, and how actors adapt to or help shape their environments (Cairney and Jones, 2016). Based on presumptions of limited cognitive and organizational information processing abilities, punctuated equilibrium theory argues that

policy agendas are relatively stable until a shock produced outside of the organization – for instance, a crisis– triggers policy activity to catch up with new demands, drawing attention and resources away from other public issues (Jones and Baumgartner, 2005; Baumgartner and Jones, 2009; Jones and Jenkins-Smith, 2009). Some triggering events analyzed through the lenses of punctuated decision making models include for example: the severe acute respiratory syndrome (SARS) episode in 2003 and Hurricane Katrina in 2005 (Lagadec, 2009), climate change (Jones and Jenkins-Smith, 2009); the 9/11 terrorist attack (Jones and Jenkins-Smith, 2009; May, Sapotichne and Workman, 2009); and airplane accidents (Cavazos and Rutherford, 2011). It has also been applied to explain “punctuated budgets” as a description of both incremental and large fiscal changes (John and Margetts, 2003; Breuning and Koski, 2009).

Punctuated equilibrium theory does not imply that policymaking is static, but that policymaking in equilibrium is fairly predictable and incremental in nature (Pump, 2011). This approach offers an explanation of the actual mechanisms that disrupt the normal patterns of policy making and alter the agenda in significant ways by incorporating the bureaucracy in its theorizing (e.g., May, Workman, and Jones, 2008; Workman, Jones and Jochim, 2009). The role of bureaucracy in this regard is twofold. On the one hand, it can serve as a link between policy subsystems by providing the institutional structure to build coherent regimes to address complex policy problems. Policy subsystems represent “regularized patterns of making policy with more or less connected sets of actors who share vocabularies and issue definitions” (Pump, 2011: 3). On the other hand, bureaucracy can also serve as an agent of change in the agenda setting process by providing valuable information to political decision makers. In the aftermath of widespread disruptions and crises, bureaucrats often have expertise that political masters can employ to make sense of such messy problems. In this regard, Baumgartner et al. (2009) note that governments are “master jugglers” that balance the competing issues seeking attention.

Punctuated equilibrium models also underscore the importance of information in the policy process by putting emphasis on both the sender and the receiver of relevant policy signals. Workman et al. (2009) indicate that the way in which public organizations process new information affects the issues to which they pay attention. They note that

how “political institutions organize themselves to process information presents opportunities for the generation of information” (p. 83). Jones and Jenkins-Smith (2009) highlight the importance of public opinion to punctuate a subsystem by transmitting signals about events across policy domains. Those authors argue that the belief of mass publics exhibit structure and coherence, within limits, around core beliefs such as ideology and political culture. As salience of an event increases, the role of public opinion in policy as a constraint and resource will increase, and vice-versa.

Overall, punctuated equilibrium models offer an explanation of how human cognitive processing interacts with political institutions to produce long periods of policy stability that are interrupted infrequently by change. As some environmental information is ignored while other information receives a great deal of attention, the policy making process may be inefficient in the sense that institutions do not respond quickly and proportionately to changes in the environment (Jones and Baumgartner, 2005). This literature suggests that more flexibility in policymaking and the empowerment of bureaucrats and political leaders are critical for the identification of emerging crises and the development of creative solutions to address them, as “no ready-made answer can be the solution to modern crises” (Lagadec, 2009: 478). As the author indicates, today’s environment demands a new culture of signal detection, new leadership styles, dynamic linkages, fluidity and speed, shared information, and collective confidence if we want to stop being continually “one disaster behind”.

## **Discussion and Conclusions**

The work of Herbert Simon and his colleagues at the Carnegie School have been highly influential on the study of attention as an organizational phenomenon. The conceptualization of attention as a scarce resource and the meaningful discussion of how such resource has to be allocated according to certain structures, factors and mechanisms have permeated the other meta-theories revised in this chapter. James March (1997: 12), one of the founders of the Carnegie School, in fact considers that “virtually all modern theories of rational choice are theories of limited (or bounded) rationality... and theories of limited rationality are, for the most part, theories of the allocation of attention.”

The literature surveyed in this chapter suggests that images or metaphors used to describe an organization and its relationship with the surrounding environment (Morgan,

1997) in part determine the definition of attention adopted in each theoretical body. They also provide different ways of understanding the attention process –i.e., top-down, bottom-up, or a mixed of both– and which role actors within and outside the organization play in such process. Levels of analysis also vary depending on what conceptualization and measurement of organizational attention are adopted, from internal teams to the broader organizational field and industry.

This review of literature on collective, organizational attention shows that there are at least three limitations that hamper our capacity to analyze the complexities and uncertainties of managing wicked policy problems, and how they are identified and understood by practitioners concerned with policy and management. First, the agenda setting and rulemaking literatures recognize that attentional events may be interdependent; however, the links between critical happenings in a specific policy domain have not been systematically examined in empirical terms. This is a major constraint of current research on government attention as every wicked problem is usually conceived of as a symptom of other (wicked) problems (Rittel, 1972; Rittel and Weber, 1973; Norton, 2012; APSC, 2007; Head, 2010; Rayner, 2006; Head and Alford, 2008). Let's think of climate change, for example: some of its driving forces operate at a global scale -e.g., global warming- while many of the phenomena that underlie environmental processes operate at regional and local scales -e.g. air and water pollution- (Fitz Gibbon and Mensah, 2012). Contrary to a single focal, triggering event that leads to near-immediate attention to the issue, such as the terrorist attack of September 11 and the US Patriotic Act signed into law on October 26<sup>th</sup> 2001, wicked policy problems require government responses able to deal with the cumulative effects of continuous and parallel overlapping events in multiple jurisdictions.

Some researchers have argued that the inclusion of any strategic issue on the policy agenda is usually affected by the set of issues already under consideration (Kingdon, 1984; Dutton, 1986). However, there is a lack of detailed investigation about the temporal and causal logics that connect attentional events and how a sequence of interrelated stimuli is linked to specific sets of government interventions. Previous research has usually prioritized three different ways of studying attentional issues: empirical case analysis of a single event or issues of similar nature (e.g., Meyer, 1982; Barr, 1998; May

et al., 2008; Rerup, 2009; Sullivan, 2010; Hoffman and Devereaux-Jennings, 2011; Cavazos and Rutherford, 2011), historical comparisons of events (e.g., Isabella, 1990; Hoffman and Ocasio, 2001), and conceptual/normative studies on the (generic) features and characteristics of certain phenomena that make them more legitimate and socially acceptable to attend than others (e.g., Downs, 1972; Kemp, 1984). Overall, what has predominated is an atomistic view of events and issues which limits the possibility of understanding how wicked problems unfold, generate cumulative effects over time, give off warning signals and, ultimately, incubate crisis that government decision makers can no longer ignore.

Second, it is usually assumed that once government focuses attention on specific problems and events these remain unchanged along the policy process and can be solved by passing legislation or making an administrative decision that drop them from the decision makers' agendas (Kingdon, 1984). From this perspective, the allocation of attention is conceived of as a single activity that occurs in a specific moment of time; either during the initial phase of the policy cycle (e.g., Dutton, 1986; Jones and Baumgartner, 2005) or as an outcome of the policymaking process in the form of new regulations, legislations, organizational changes or budget decisions (Kemp, 1984; Peters and Hogwood 1985; May et al. 2008; Sullivan 2010; Mortesen, 2005;). This conceptualization of collective attention can be useful for explaining episodic allocations of information processing capacity and resources (e.g., time and effort) to a well-defined critical event during short periods of time. However, it might not work well when we try to tackle a wicked policy problem that is highly contestable from the start (e.g., climate change), continually changes and evolves, produces chronic policy failures, and requires constant attention and action (Australian Public Service Commission [APSC], 2007; Jentoft and Chuenpagdee, 2009). In this sense, I agree with Howlett et al. (2014) on their critique to the punctuated equilibrium theory and the agenda setting models in that they presents an idealised image of policy making rarely encountered in the real world of powerful political agents, ideology, turbulence and complexity.

Third, viewing attention as a result of a discrete intervention –i.e., the introduction of a topic on the political agenda, a decision input or a policy outcome– is indeed a reductionist and limited way of describing and explaining what is actually a continuous

longitudinal process that involves many organizations at different levels of government. The responses implemented by any public organization to tame a wicked policy problem, therefore, should not be analyzed as independent or entirely discrete, nor can be assumed that a final policy decision will solve that problem, as the agenda- and rule-making literature usually do. When dealing with wicked problems we should always keep in mind that each formal government intervention is necessarily embedded in a sequence of events, occurs in relation to others that precede and follow (Peterson, 1998), and it is likely that every response or solution will create new problems that would also demand the attention of public officers and managers.

From a methodological point of view, a process approach that understand this phenomenon as a sequence of interrelated events and underlying generative mechanisms or patterns (Tsoukas, 1989) has the capacity to provide more meaningful explanations than the ones obtained from variance theories that have dominated mainstream research on government attention. A variance approach to attention requires evidence of co-variation of organizational characteristics, temporal precedence and absence of spurious associations in order to consider that the independent variables are causally related to the dependent variable (Van de Ven and Huber, 1990; Hager, 1998). Variance theories produce nomothetic causal explanations that make probabilistic claims based on the patterns of co-variation among variables –i.e., when two or more variables differ in consistent ways from case to case– (Hager, 1998). Such approach presents serious limitations to analyze government attention to wicked problems because it employs a-temporal variables seeking general covering law-like regularities (Buttriss and Wilkinson, 2014) that cannot capture the uniqueness and context-specificness of sustainability issues.

Despite these drawbacks, the literature on attention offers a series of important takeaways to be considered to plan and develop the three studies that make up this dissertation. First of all, building on the ABV definition of attention that encompasses different reviewed meta-theories, in the three studies the analytical focus will be put on both *issues* and *answers* –i.e., “the cultural and cognitive repertoire of schemas available to decision-makers in the firm to make sense of (issues), and to respond to (answers) environmental stimuli” (Ocasio, 1997: 194)– and patterns of organizational attention – i.e., “the distinct focus of time and efforts by the firm on a particular set of issues,

problems, opportunities, and threats, and on a particular set of skills, routines, programs, projects and procedures” (Ocasio, 1997: 188). Accordingly, in this dissertation government attention to wicked problems will be understood as the socially structured pattern of attention by decision makers in a public organization, which guides how they select from and respond to complex and conflictive stimuli (Yaniv and Schwartz, 2011).

Second, it is important to understand the distinctive characteristics of a wicked problem as an *issue* because they determine the possible coping strategies to deal with it (Roberts, 2000) and shape attention allocation and organizational adaptation to environmental changes at different levels, as the issue selling, the ecological perspective and the ABV literatures suggest. Study #1 (qualitative systematic review) is in fact dedicated to better understand the wicked dimensions of sustainability-related problems (issues) and how they impact the design and implementation of potential solutions to such problems in the public sector (answers).

Third, the managerial cognition, issue-selling, agenda-setting and ABV perspectives highlight that patterns of attention to environmental stimuli (issues) are not only shaped by their objective characteristics, but also by the way they are interpreted, enacted and/or coded that eventually determine which responses are launched (answers). The language and labels used to frame a wicked problem are important for drawing attention to or away from it, reflecting different understanding of the issue and resulting in different patterns of attention allocation. Study #2 (experimental design) will further investigate the framing effects of contradictory but equivalent definitions of a wicked problem on solutions preferred by individual decision makers.

Fourth, I endorse the behavioural approach’s arguments that attention is scarce resource and that organizational decision makers have a limited capacity to notice and process a certain amount of stimuli and concurrent issues in a given time period. Hence, it is important to understand patterns of attention allocation on wicked problems, as they help organizations to focus attention on these specific issues and prevents attention from being distracted to less important and perhaps peripheral issues (Ocasio 1997 and 2011). To better understand attention allocation, in Study #3 [case study of the Department of Fisheries and Oceans (DFO)] I develop a process-oriented model focused on a small number of key strategic decisions (answers) that followed specific social-environmental

events (issues). Building on the work of Cyert and March (1963), I view decisions of DFO as the result of a sequence of behaviours in that organization and will study those decisions by analyzing the process of attention allocation. Study #3 is focused on decisions made at the ministerial level to deal with a particular wicked problem, the sustainability of wild Pacific salmon in British Columbia. Although this can be seen mainly as top-down approach to process of attention, I also acknowledge that in such context, inhabited by a variety of stakeholders –many with contradictory values and goals–, it is important to consider the policy subsystem where the case is embedded, including the role of different constituencies and the media in initiating the attention process and shaping the pattern of attention allocation, as the issue selling, ecological perspective, punctuated equilibrium and ABV literatures suggest.

## Chapter 3. Systematic Review on Wicked Policy Problems (Method)

### Introduction

In their seminal article 'Dilemmas in a General Theory of Planning' published by *Policy Sciences* in 1973, Horst Rittel and Melvin Webber conceived of "the problems of governmental planning, especially those of social or policy planning" essentially as wicked (p. 160). Their theory of wicked problems is based on ten properties that distinguish the planning-type of problems that underlie modern professions from the tame problems that scientists and engineers have usually focused upon (Rittel and Webber, 1973; see Chapter 2). According to Rittel and Webber's list of characteristics, wicked problems defy the conventional approaches and skill sets of planning, management and policy-making, and their underlying traditional problem-solving strategies that only provide partial tame solutions.

According to Coyne (2005: 6), Rittel and Webber's work was an "appropriate antidote" to the generalist, rationalist problem-solving approach proposed by Simon (1968) and von Bertalanffy (1969) that inspired much of the currents of thoughts that have dominated organization theories in the public sector until our days. It is fair to say though that students and faculty members in most public administration and policy schools are more familiar with the language of problem definition, goals, rules, search, solution and hierarchy, than with the distinction between wicked and tame problems, or the principles of maximized involvement, objectification and moderate optimism of the system approach of the second generation proposed by Rittel and Webber (1973).

Over the last two decades, along with the rise of complexity theory in strategic management, organizational studies, political science and public policy (Cairney, 2012), several experts in the field of public administration and policy analysis have shown an increased interest in the wicked problem theory to illustrate social needs that the scientific progress has proved inadequate to meet (Batie, 2008). This rapid growth of research, while commendable, has also created some confusion about Rittel and Webber's terminology and the radical edge of their original proposition. Explained in part by their broad and comprehensive definition of wicked problem as "societal problems", the wicked/tame taxonomy has been used to illustrate very diverse policy issues: from major

global problems as climate change, racism and terrorism, to more context-specific challenges as the regulation of the equine industry (Andersson and Lehtola, 2011), human-elephant conflicts in Indian coffee plantations (Bal et al., 2011) or the coordination and financial challenges of cultural entrepreneurships (Acheson, Maule and Filleul, 1996).

Xiang (2013) found in his survey of 332 peer reviewed scholarly publications on wicked problems that much of the research and scholarship on the topic remain largely a repetitive description of the social reality of wickedness, rather than well-grounded theoretical explorations or empirical investigations. The research focus has been mainly placed on advocating creative adaptation strategies and innovative solutions to wicked problems, but there is little accumulated knowledge on exactly how such responses can be materialized on theoretical and/or empirical grounds. According to Norton (2005: 133), Rittel and Webber's list is "redundant and apparently reveals no internal organization—it is just a list of characteristics" that can be usefully collected under a unifying definition of *wicked problems*. Moreover, it is worth noting that the problems that public officers and policy-makers of the 21st century are expected to solve are notoriously different, more chaotic and unpredictable than the societal issues Rittel and Webber were dealing with in the early seventies, namely, the outcomes of the planned housing projects in the U.S. of the 1950s and 1960s: crime, poverty and social segregation (Mascarenhas, 2009). Planning for climate change or sustainable development differs from traditional urban planning, for instance, in terms of the availability of knowledge and experience about the efficacy of particular responses, the required interdependencies between levels and types of governance, and the current state of the science compared to that of the early seventies (Rayner, 2006; Crane and Landis, 2010; Andersson and Lehtola, 2011).

It is therefore important to advance from the list of properties presented by Rittel and Webber to the understanding of how those properties interplay, what implication they have for policymaking, what solutions and strategies make more sense than others in specific contexts, and what the role of current public organizations may be in taming wicked problems. In order to contribute to this field of study, I undertake a qualitative systematic review of literature that will advance the understanding of the main sources of

wickedness of issues that public officials currently face in the public sector, and the problem-solving strategies that have shown a certain degree of success in addressing such problems. As it is further explained below, this review is focused on wicked problems in the field of sustainability and/or sustainable development, allowing the inclusion of a diverse sample of social-ecological issues into the synthesis. The systematic review process was accordingly designed to address the following two set of research questions:

Firstly, (i) what are the main sources of wickedness of public policy problems in the field of sustainability?; (ii) what are the challenges that such sources of wickedness pose for policy making/problem solving processes in the public sector? Secondly, (iii) what are the problem-solving strategies that have been successful in addressing wicked sustainability problems?; (iv) what are the factors that contribute to the success or failure of such solutions?

The terms *successful* and *success* are used to frame the research questions -instead of *effective* and *effectiveness* which are commonly used to assess public policies and programs- because they indicate in a more precise way progress done to tame a wicked problem. In a traditional sense, effectiveness is a formal evaluation criterion that represents the extent to which objectives are achieved and targeted problems are solved. However, according to Rittel and Webber's definition, wicked problems cannot be solved; therefore, a different term is needed to judge actions taken to address such societal issues. A successful solution in this sense can be considered as "creative and flexible combinations of...various forms of organizing, perceiving and justifying social relations" (Verweij et al., 2006: 818) rather than the achievement of remote targets. Success in taming a wicked sustainability problem might acquire different meanings, for instance: changes to underlying governance structures (Frame, 2008), the maintenance of a creative learning framework for planning (Gray and Gill, 2009), the institutionalization of stakeholder involvement and the formation of collaborative structures of stakeholders, policy makers and scientists (Sandström, 2010), or even the lack of major opposition to a project during its life span (Schmitt, 2010).

The purpose of this chapter is to present the method used to answer these questions, illustrating this field of research, theories and research methods used, the plurality of

existing definitions and problem solving approaches. The results of the study are presented in Chapter 4. The goal of this systematic review process is threefold:

- to present a state-of-the art of the existing literature on wicked policy problems;
- to develop a conceptual framework that explains the main sources of wickedness of public policy problems and their consequences for policy making/problem solving at government organizations;
- to suggest a series of propositions that, based on the systematization of empirical findings, help to increase the success of problem-solving approaches to wicked sustainability problems.

## **Method**

The use of qualitative systematic reviews in public administration research and practice is not novel; it is directly linked to the rise of the evidence-based policy and practice movement which has gained in momentum since the early 1990s in the UK, Australia, Canada and the US (Dixon-Wood et al., 2006). A qualitative systematic review consists of using methods for reviewing literature following a transparent and reproducible process that emphasizes the same degree of rigorousness that is expected of primary research (Gough et al., 2013; Greenhalg et al., 2005). The collection and synthesis of data extracted from relevant literatures may differ in how the work is done at each stage of the process, the order of stages and the importance of each stage. Notwithstanding, all systematic reviews have each of the following phases to ensure that collected data are as complete and representative as possible of all the research that has been done on a specific topic: formulation of the review question(s); definition of eligibility criteria; search of information sources; selection of items to be reviewed; assessment of quality and relevance of selected studies; data extraction; and synthesis of findings to answer the review question(s) (Dixon-Woods et al., 2005 and 2006; Gough et al., 2013; EPPI-Centre, 2010; Moher et al., 2009). In order to analyze a sample of the existing empirical literature on wicked policy problems, these stages were integrated into a four-step procedure: 1) searching; 2) screening and assessment; 3) mapping and sampling; and 4) synthesis. Similar review procedures have been undertaken by Turrini et al. (2010) and Ananiadou et al. (2009).

## Searching

The first step is aimed at identifying and collecting all existing studies that use the term *wicked problem* or *wicked issue* to describe socio-ecological challenges and demands that fall or might fall under the purview of public officials and governmental organizations (e.g., ministries, secretaries, agencies, crown corporations). This broad conceptualization of the term wicked problem is consistent with Rittel and Webber (1973) general definition (“societal problems”) and the research questions mentioned above. It also helps to identify publications where the authors do not consider a particular wicked problem as a public policy issue (although it may actually be one), and items not published by public policy-centered resources.

In this first stage of the review process the research questions are critical to determine what types of studies to include in the review and the strategy that has to be used to search for potentially relevant items. Depending on the research questions, the systematic reviews can be categorized as configurative (also known as interpretive) or aggregative. The former seeks to develop and explore theory by interpreting ways of understanding phenomena and their meaning or value to people, without specifying concepts in advance of the synthesis or fixing the meaning of those concepts at an early stage. The latter aims to aggregate information and observations using well determined concepts (categories or variables) within a particular theoretical framework, in order to test theory about the presence, distinctions or associations of phenomena (Gough et al., 2013; Gough, 2013; Dixon-Woods et al., 2005 and 2006).

Gough et al. (2013) explain that, on the one hand, a configurative approach to research reviews is concerned with meaning and interpretation in order to develop ideas and theories. It tends to use exploratory and iterative inductive approaches that emerge through the process of the research. A configurative synthesis often relies on a small number of detailed cases to develop an understanding of processes and mechanisms and meanings. In this case, heterogeneity between studies is more useful than homogeneity as a spread of different and unusual cases may provide greater insights than a representative sample that reveals more about typical cases. An aggregative review, on the other hand, specifies its concepts and variables in advance, is based on deductive reasoning and concerned with measuring, adding and comparing measures extracted from the literature.

The aggregative approach does not develop theory directly but it can lead to theory development through empirical testing of theoretical assumptions. Unlike the configurative approach, an aggregative review seeks homogeneity rather than heterogeneity between the studies in order to avoid biases that may distort measurement. Meta-analysis, a statistical method often used in medical research, is one of the most illustrative examples of an aggregative systematic synthesis.

Although all syntheses involve some type of summary of the data and some form of interpretation, classifying a review either as aggregative or as configurative is critical for the entire review process. The distinction between these approaches is related to the purpose of the synthesis and reflected in the review method and what each review stage actually involves (Dixon-Woods et al., 2006). Given the nature of my review questions (i.e., a *what is this phenomenon*-type of question, according to Gough et al., 2013) and the objectives of this study, I performed a configurative systematic synthesis using a comprehensive search strategy.

First, I defined a number of keywords and search strings that have been entered in three electronic databases: Web of Science, EBSCO and JSTOR. I decided not to conduct searches in Google Scholar given that it has serious limitations to perform a systematic review (Gough et al., 2013; Anderson, 2013). Moreover, initial searches of *wicked problem* and *wicked issue* on scholar.google.ca showed over 203.000 and 140.000 results as of April 2014, respectively. Due to time and resource limitations more specific searches were conducted only in the three aforementioned databases in the following way. I started with a general search using broad queries (i.e., *wicked problem* and *wicked issue*) to get a general overview of the topic. Then I refined the queries including more specific terms (e.g., *government*, *public administration* and synonyms) in order to strike a balance between sensitivity –i.e., finding all articles in a topic area– and specificity –i.e., finding only relevant articles– (EPPI-Centre, 2010). To supplement the results coming from these databases I also ran queries in the Directory of Open Access Journal (DOAJ, <https://doaj.org/>). More information about the resulting queries is provided in Appendix A. Second, I created an alert on Web of Science (expired on August 14, 2014) that kept me notified when a new record on wicked policy problems was uploaded to that database

without searching for new items on a regular basis. Third, I also included hand-searched items that could not be found in the selected bibliographic databases.

Given the configurative nature of this review I defined broad eligibility criteria. The queries were built to search and identify: 1) traditionally published material (i.e., electronic books, articles, editorials, book chapters) and grey literature (i.e., conference proceedings, presentations, white and policy papers); 2) records not limited by discipline, study design, date, country or geographic region; 3) records published in English, Spanish, Italian or Portuguese; 4) full-text items that could be downloaded for free or from the University of Victoria Libraries.

### **Screening and Assessment**

The second phase of the review was focused on narrowing the scope of the search by reducing the initial collection to only the relevant documents that matched the inclusion criteria and the above definition of wicked problems. To do so, I followed a two-stage screening process (Gough et al., 2013): first, the title and abstract were screened to determine whether the study was likely to be potentially relevant; second, full text articles of studies that met the inclusion criteria were obtained and fully screened. During this second stage I performed a basic quality assessment to better judge the execution of the studies and the relevance of selected records to addressing the review questions.

Quality appraisal of qualitative research is always problematic and whether it should be done for purposes of a systematic review is a matter of debate: there are over 100 sets of proposals and published scales for assessing study quality in qualitative research, some adopting non-reconcilable positions on a number of issues (see Dixon-Woods et al., 2004). The way in which “weak” qualitative findings should be attenuated or excluded in any synthesis is not yet clear and arriving at consensus on quality criteria have proved difficult (Dixon-Woods et al., 2006). Notwithstanding, some means of appraising qualitative research is always recommended if it is intended to contribute appropriately to a systematic review. For configurative approaches like the one conducted here, quality assessment usually involves appraising studies against the needs of the review rather than against standard criteria (Gough et al., 2013).

Given the configurative nature of this study and my broad eligibility criteria, I used Dixon-Woods et al. (2004) standard form for appraising qualitative research as a model

to develop my own quality assessment instrument. As it is shown in Appendix B, this instrument is mainly focused on the congruity between the review questions and the use of the term *wicked problem/issue* to describe the following: a policy problem based on Rittel and Webber's theory; the clarity of the description of the study design; the existence of evidence to support authors' arguments and claims; and the general contribution of the paper to answer the review questions. This instrument was useful to exclude, for instance, papers that use the term to depict issues that cannot be defined as a policy issue and/or are related to the practice of a specific profession and discipline (e.g., teaching engineering, hospital administration, art, radiology, nursing).

Based on this assessment, I grouped the selected items into empirical and non-empirical studies. The former refers to reality-oriented research based on primary and/or secondary sources of information and explicit data collection and analysis strategies (Patton, 2002). The latter are non-evidence-based studies where the term *wicked problem* was mostly employed conceptually and normatively to refer to general social issues rather than to context specific socio-ecological phenomena. Only empirical studies were mapped, sampled and synthesized as it is explained below.

### **Mapping and Sampling**

Once the screening stage was completed, the next step to create a literature map is to develop codes that describe the research field and inform the selection of studies for the synthesis stage. The selected items were coded on the following variables: year of publication; content type (e.g., journal article, e-book, book chapter, conference proceedings, editorial, etc.); source (e.g., name of the journal or book where the item was published); country (based on the authors' institutional affiliation); policy area; disciplines; and wicked policy problem (main focus of the study reviewed).

Besides their descriptive capacity, map codes also provide an opportunity to sample a sub-group of studies for synthesis, which helps reduce the number and heterogeneity of studies, their methodological complexity and the lack of time and resources (Gough et al., 2013). The question of whether sampling is acceptable in syntheses of qualitative research is one which has also received considerable attention and created an on-going debate about its methodological appropriateness (see Dixon-Woods et al., 2006). In the case of configurative synthesis, it is argued that the same logic that governs sampling for

primary qualitative research might apply; therefore, the notion of theoretical saturation might have value (Paterson et al., 1998; Schreiber et al., 1997; Dixon-Woods et al., 2006; Gough et al., 2013). Contrary to aggregative reviews that intend to be as exhaustive as possible to avoid bias and increase confidence in their findings, in a configurative approach as the one adopted in this study it is acceptable that a reviewer identifies the items that are intuitively deemed the most significant in a particular field when some relevant examples of a particular element in their configuration –such as a specific context– have been found (Dixon-Woods et al., 2006; Gough et al., 2013; EPPI-Centre, 2010). In this research, I decided to apply a selective sampling method (EPPI-Centre, 2010) in order to synthesize sufficient examples and evidence of different types of wicked problems.

The sample includes empirical studies on wicked sustainability problems (and/or wicked issue related to sustainable development) as they offer the possibility of integrating and synthesizing different types of socio-ecological challenges that cover a variety of policy areas, a broad range of academic disciplines and the full range of contexts, to local to global. Acknowledging the variation in the meanings and understandings ascribed to the notion of sustainability (today with over 250 published definitions according to Gray and Gill, 2009; see also Norton, 2005), here I chose a broad conceptualization of the term to identify policy problems related to this phenomenon. I follow Peterson's broad definition of sustainability as "simultaneous demands for economic feasibility (profit), benign environmental impact (planet), and enhanced social outcomes (people)" (2013: 13). From this point of view, the concept *sustainability* can be used interchangeably with *sustainable development*, meaning continuity into the future and balanced decision making from a social, economic and environmental perspective to preserve the quality of the natural ecosystems while meeting the needs of a variety of stakeholders (Williams, 2006; Bouma et al., 2011; Segrave et al., 2012; Wilkinson and Mangalagu, 2012). Building on the work of Horiuchi (2007) and Anthony (2012), henceforth I will use the term *wicked sustainability problems* to refer to social and ecological challenges and issues related to production and consumption practices aimed at assuring that present needs are met and adequate resources will be available for generations to come with limited ecological degradation.

The sample only includes resources where the authors explicitly defined a sustainability challenge (or a sustainable development related issue) as a wicked problem. The scope of the review was restricted to studies that focus explicitly on the notion of *wicked problem* in combination with *sustainability/sustainable development* and not, for instance, climate change or other related issues that are wicked problems but not necessarily identified as a sustainability challenge by the authors. The reason for sampling social-ecological challenges in the field of sustainability is that they represent a clear example of wicked problems that cross-cut the agenda and activities of most government departments, are not marginalized in a single-purpose and environmentally focused service unit, and cannot be subject to “simple” engineering-based solutions (Williams, 2006; Herrick and Pratt, 2012).

Additional codes were developed to analyze the items on wicked sustainability problems: research design; data collection instrument; data analysis strategy; and recommended solution and/or problem solving approach. The empirical studies on wicked sustainability problems were synthesized as it is explained below.

### **Synthesis**

Dixon-Woods et al. (2005) present several strategies for synthesizing the evidence provided by systematic reviews, ranging from techniques that are largely qualitative and interpretive through to techniques that are largely quantitative and integrative. The former refer to methods such as narrative summary, thematic analysis, grounded theory, meta-ethnography, meta-synthesis, meta-study, realist synthesis, and Miles and Huberman’s (1994) data analysis techniques. The latter techniques include content analysis, case survey, qualitative comparative analysis and Bayesian meta-analysis.

The choice of the type of synthesis is directly related to the form and nature of the review questions being asked. In a configurative study, like the one presented here, a synthesis is inherently an interpretive, creative process that generates new concepts, theories and/or higher level explanations grounded in the data and evidence reported in the selected studies (Gough et al., 2013; EPPI-Centre, 2010; Dixon-Woods et al., 2005). In this case, I decided to conduct a thematic analysis which is a technique aimed at identifying recurrent and prominent core meanings (usually called 'themes' or 'patterns'), and summarizing the findings of different studies under thematic headings (Patton, 2002).

It is usually argued that one of the problems with thematic analysis is the lack of explicitness and clarity about what this analysis actually involves, the process and procedures by which it can be achieved, and how the themes are weighted and valued to determine their explanatory value (Dixon-Woods et al., 2005). In order to reduce the risk of bias and give more transparency to the way the qualitative data was handled, I conducted a computer assisted qualitative data analysis (CAQDAS) using QSR International's NVivo 10 Software. The synthesis followed a four-step procedure: (i) creation of categories related to wicked sustainability problems and its determinants, (ii) creation of summary tables that provide descriptions of key points found in the literature; (iii) identification and interpretation of themes and patterns between categories; (iv) integration of findings from the sampled studies to answer the review questions.

## **Conclusions**

The decision of doing a systematic review to answer the research questions is based on its capacity to combine the findings of different types of study designs and researches that are highly relevant across a wide range of public policy areas (Gough et al 2013; Dixon-Wood et al., 2006). Over the last few years qualitative systematic reviews have been applied to study very specific wicked problems, such as the designation of risk zones in publicly funded flood insurance programs (Zia and Glantz, 2012), the challenges and issues found in public network settings (Lecy et al., 2014; Turrini et al., 2010), food security (Candel, 2014), and the provision of health services in rural areas (Humphreys et al., 2009). To date, though, there is a lack of systematic and structured studies that integrate the highly fragmented literature on wicked sustainability problems which is dispersed in a variety of public policy areas, research lines and disciplines. The inclusive character of this method is particularly relevant for this doctoral dissertation due to the diversity of policy problems that can be defined as wicked in the field of sustainability and/or sustainable development and the variety of multidisciplinary approaches and study designs adopted to analyze them.

Although the entire review process accurately followed the aforementioned research protocol to synthesize a body of literature as comprehensive and diverse as possible, this study is not free from limitations and biases that may affect the interpretation of the review findings. First of all, incorporating qualitative research in systematic reviews is

inherently challenging: as Dixon-Woods et al. (2006: 40) indicate “[t]here is an uneasy fit between the frame offered by conventional systematic review methodology and the kinds of epistemological assumptions and research practices associated with qualitative research.”

Second, systematic reviews are usually conducted by groups or teams of reviewers, rather than being a one-man job like in the present study. This is due not only for resource efficiency reasons (time and money) given the amount the items to review, but also to improve the accuracy and quality of the study. Having a group of reviewers/coders is useful to explore and explain differences in findings and determine the importance or significance of a theory or concept that appear recurrently in the reviewed literature (Gough et al., 2013).

Third, the searches were mainly conducted using three big databases (Web of Science, EBSCO and JSTOR) that cover a significant amount of international peer-reviewed journals. However, it has to be acknowledged that more specialized databases might cover other potentially relevant non-indexed journals or non-academic resources that could lead to additional insights. Similarly, the body of the reviewed literature is dominated by publications from the Northern hemisphere and items written in English, whereas publications in other languages and from other parts of the world, such as Asia, Franco-phone Africa and Latin America, are underrepresented. Another potential bias may be related to language barriers. As explained by Xiang (2013), it is possible that many people have been, and may well continue to be, working with wicked problems without knowing it or without calling them as such; therefore, they do not even bother to produce research using the Rittel and Webber's (1973) concepts.

## Chapter 4. Systematic Review on Wicked Policy Problems (Findings)

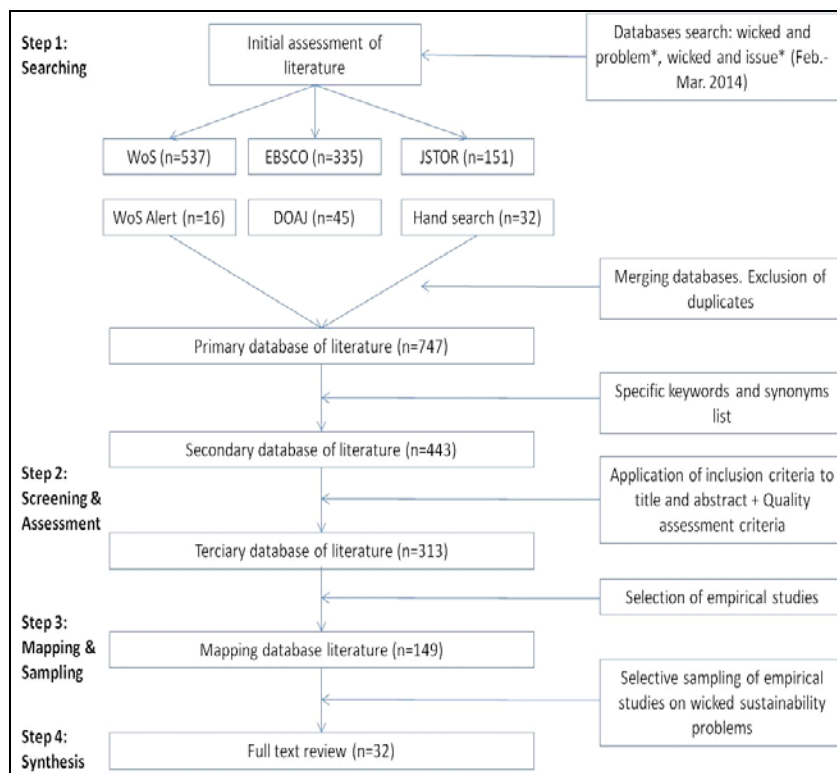
### Introduction

This chapter presents the map and synthesis of empirical studies on wicked policy problems in the field of sustainability and/or sustainable development according to the research procedure described in the previous chapter. Based on the findings of the systematic synthesis I develop a conceptual framework that is used for guiding data collection and analysis in Study #2 (Chapters 5 and 6) and Study #3 (Chapters 7 and 8). The chapter begins with the main findings of the searching and mapping stages of empirical studies on wicked policy problems, followed by more specific results on sustainability issues. Two syntheses are presented separately to answer the review questions. The final sections of this chapter are dedicated to discussion and conclusions.

### Description of the map of literature

The entire data collection process is described schematically in Figure 4.1.

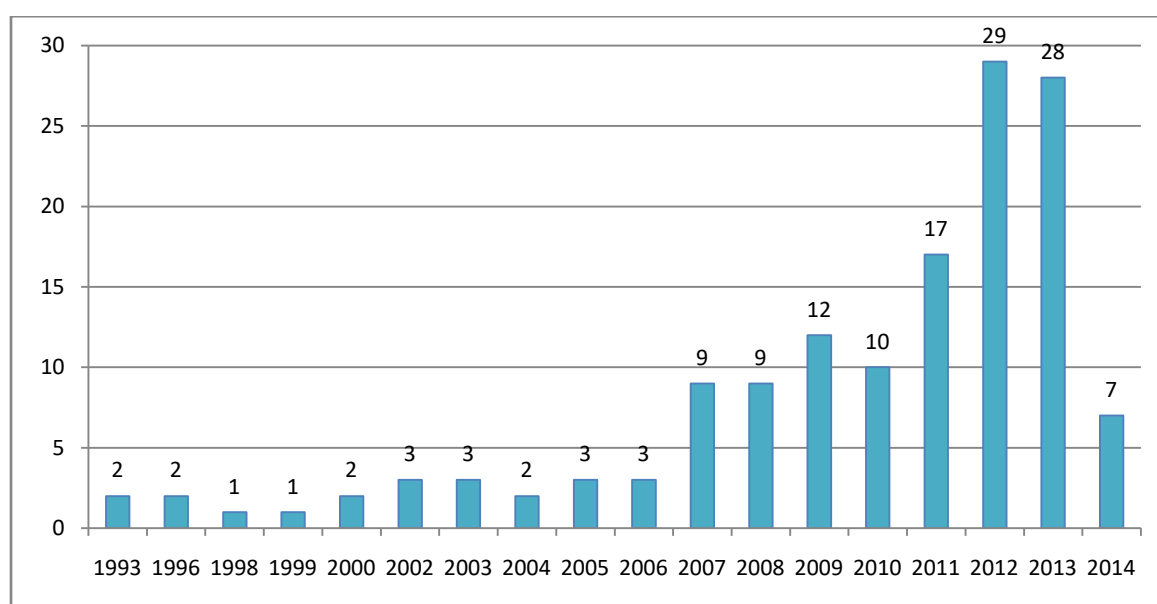
**Figure 4.1. Data collection process**



Source: own

The map of literature was built to reflect the descriptive features of the body of empirical literature on wicked policy problems that met the inclusion criteria (n=149). As shown in Figure 4.2, the first empirical resources found on *wicked problems/issues* were published two decades after Rittel and Webber coined the term, showing an upward trend from 2007 onwards. Whereas none of the years before 2007 includes more than four documents on the topic, this figure increases to nine in 2007 and 2008, and up to 29 and 28 in 2012 and 2013, respectively.<sup>1</sup>

**Figure 4.2. Number of empirical research on wicked problems**



Source: own

Despite the eligibility criteria were broadly defined to include a variety of content types, 93% of the items included are journal articles (n=139) and 7% are book chapters (n=10). Following the search process described in Chapter 3, I was unable to identify conference proceedings, presentations, white and policy papers that met the inclusion criteria.

Regarding the countries where the empirical research on wicked policy problems was originated, the literature reviewed is geographically scattered, presenting a huge disparity across regions of the world. The vast majority of studies (79%) come from researchers

<sup>1</sup> The year 2014 only includes items found between January and August, when the searching stage finalized.

affiliated to institutions in six countries (USA, Australia, U.K., Netherlands, New Zealand and Canada), 10% are originated in other countries, and 11% (n=17) of the selected items are collaborations among researchers working in institutions located in different countries (see Table 4.1). The institutions with which corresponding authors are affiliated spread over 25 countries, but resides almost exclusively in Anglophone developed countries. This geographical disparity may be explained by inherent limitations and biases of the review process explained in the previous chapter.

**Table 4.1. Empirical publications on wicked problems by country\***

<b>Country</b>	<b>Total</b>	<b>Percentage</b>
USA	35	23,5%
Australia	25	16,8%
United Kingdom	26	17,4%
Netherlands	19	12,8%
New Zealand	7	4,7%
Canada	5	3,4%
Norway	3	2,0%
Switzerland	2	1,3%
Sweden	2	1,3%
Finland	2	1,3%
Greece	2	1,3%
Austria	1	0,7%
Germany	1	0,7%
India	1	0,7%
Italy	1	0,7%
Inter-country collaborations	17	11%
<b>Total general</b>	<b>149</b>	<b>100%</b>

Source: own

\* See complete table in Appendix C

The reviewed literature covers a broad range of policy areas, as shown in Table 4.2. Almost 75% of wicked policy problems are found in seven policy areas: environment, public health, agriculture, urban development, water management, as well as problems in the field of policy making and public management that are common to several policy areas. Examples of the latter include issues related to knowledge management (Labeledz, Cavaleri and Berry, 2011), organizational change (Pries-Heje and Baskerville, 2008; Jenner, Barnes and James, 2013), public e-participation in decision making processes

(Loukis, Xenakis and Tseperli, 2009; Xenakis and Loukis, 2010), and relations between the State and the civil society (Jakubowicz, 2011). As it can be appreciated in Table 4.3, although some wicked problems are limited to specific policy areas (e.g., provision of public health, national security), most of the issues cut across several fields.

Table 4.4 summarizes the categories assigned by ISI Web of Knowledge Journal Citations Report to the items published in ISI-indexed journals and books (n=81). As shown below, the concept of wicked problems has been also used and developed in a broad range of academic disciplines. Public administration, environmental sciences and interdisciplinary studies are at the top of the list.

**Table 4.2. Empirical publications on wicked problems by Policy Areas**

<b>Policy Areas</b>	<b>Total</b>	<b>Percentage</b>
Environment	24	16,1%
Public health	19	12,8%
Agriculture	17	11,4%
Policy making and analysis	14	9,4%
Urban development	14	9,4%
Public management	11	7,4%
Water management	11	7,4%
Fisheries	7	4,7%
National security and Defense	6	4,0%
Education	5	3,4%
Local government	4	2,7%
Energy	3	2,0%
Forestry	3	2,0%
Disaster and Emergency management	2	1,3%
Family and child issues	2	1,3%
Economic policy	1	0,7%
e-government	1	0,7%
Employment	1	0,7%
Environment and Public health	1	0,7%
Indigenous affairs	1	0,7%
Sports	1	0,7%
Tourism	1	0,7%
<b>Total general</b>	<b>149</b>	<b>100%</b>

Source: own

Table 4.3. Wicked problems grouped by Policy Area\*

POLICY AREAS	WICKED PROBLEM (GENERAL)	TOTAL
Environment	Pollution	4
	Environmental sustainability	3
	Dryland management	2
	Natural resource planning	2
	Protection of endangered species	2
	Environmental regulation	1
	Long term funding for governance institutions for climate adaptation	1
	Indirect land-use change	1
	Nuclear waste management	1
	Climate-mediated changes in wildfire regime	1
	Climate change	1
	Housing and accommodation in mining-affected communities	1
	Climate change adaptation	1
	Unmanaged recreation in national forests	1
	Airport expansion	1
Global environmental issues	1	
	<b>Total Environment</b>	<b>24</b>
Public health	Provision of public health services	6
	Public health issues (obesity, sexual health, alcohol misuse, etc.)	3
	Pollution (environmental health problem)	3
	Institutional abuse in care settings	1
	Health inequalities	1
	Public drinking	1
	Quality problems in health care	1
	Early childhood safety at home	1
	Genetically modified food production	1
	Potential risks of emerging technologies	1
	<b>Total Public health</b>	<b>19</b>
Agriculture	Environmental sustainability	4
	Food security	2
	Human-elephant conflicts	1
	Climate change and Food security	1
	Sustainable development	1
	Climate change	1
	Horse-related problems	1
	Environmental sustainability and Food security	1
	Sustainable biomass utilization	1
	Evaluation of subsidy programs	1
	Sustainable production of soy	1
	Branding in rural areas	1
	Global environmental issues	1
	<b>Total Agriculture</b>	<b>17</b>
Urban development	Sustainable urban planning	4
	Climate change adaptation	2
	Urban decline	2
	Climate change and Socio-spatial inequality	1
	Social and Environmental sustainability	1
	Traffic congestion	1
	Climate change	1

	Environmental sustainability	1
	Regional planning	1
	<b>Total Urban development</b>	<b>14</b>
<b>Policy making and analysis</b>	"Wicked problems" [General]	3
	Policy making and implementation	2
	State-Civil society relations	1
	Anti-social behaviour	1
	Nimby (not-in-my-backyard) syndrome	1
	Brain drain	1
	Social exclusion	1
	Dryland management	1
	Water governance + Airspace regulation	1
	Employment and national insurance administrations	1
	Knowledge management in government policy-making groups	1
	<b>Total Policy making and analysis</b>	<b>14</b>
<b>Water management</b>	Water governance	4
	Water sector sustainability	1
	Groundwater contamination	1
	Dryland management	1
	Water pollution	1
	Environmental sustainability	1
	Climate change	1
	Flood safety	1
	<b>Total Water management</b>	<b>11</b>
<b>Public management</b>	"Wicked problems" [General]	2
	Planning and management of public events	2
	Organizational change	2
	Social and Environmental sustainability	1
	Emergency management, Environmental regulation and	1
	Community renewal	
	Sustainable development	1
	Leadership in regional engagement	1
	River management	1
	<b>Total Public management</b>	<b>11</b>
<b>Fisheries</b>	Ecosystem recovery	1
	Reef degradation	1
	Protection of (endangered) species	1
	Lack of adaptability in fish stocking policy	1
	Social and environmental sustainability	1
	Management of marine biodiversity	1
	Poverty	1
	<b>Total Fisheries</b>	<b>7</b>
<b>Other policy areas*</b>	Other wicked problems*	32
	<b>TOTAL GENERAL</b>	<b>149</b>

Source: own

\*Note: see complete list of wicked problems grouped by policy areas in Appendix D.

**Table 4.4. Disciplines related to sources on wicked policy problems\***

<b>Journal subject categories in Journal Citations Report</b>	<b>Total</b>
Public Administration	12
Environmental Studies	7
Planning and Development; Public Admin.; Social Sciences, Interdisciplinary	5
Education and Educational Research	4
Environmental Sciences	4
Political Science; Public Administration	4
Environmental Studies; Public Administration	3
Management; Social Sciences, Interdisciplinary	2
Political Science	2
Information Science and Library Science; Management	2
International Relations	2
Health Policy and Services	2
Economics	2
Public, Environmental and Occupational Health	2
Information Science and Library Science	2
Health Policy and Services; Public, Environmental and Occupational Health	2
Other disciplines*	24
<b>Total</b>	<b>81</b>

Source: own

\*Note: see complete list in Appendix E.

### **Description of the data on wicked sustainability problems**

The sample of studies on sustainability/sustainable development included 32 items (28 journal articles and 4 book chapters), which represents 21.5% of the entire database of empirical research on wicked policy problems. Of those, 25 sampled items defined sustainability and/or sustainable development related issues as a wicked problem, while the remainder either discussed sustainability policy problems without explicitly defining the notion, or did not have sustainability as their core focus but provided some insights on the margins. These are two resources related to water governance (Weber, Memon and Painter, 2011; Segrave, Buscher and Frijns, 2012), and one from each of the following fields: public health (Cunningham, Ranmuthugala, Westbrook and Braithwaite, 2012), natural resource management (Gray and Gill, 2009), sustainability and food security (van Latesteijn and Rabbinge, 2012), climate change and socio-spatial inequality (Acuto, 2012), climate change and food security (Anthony, 2012).

Based on the aforementioned ISI Web of Knowledge Journal Citations Report, the various sources in which the sampled academic articles were published cover a broad range of disciplines within both the natural and the social sciences. Among these fields are Agricultural Economics and Policy (n=7), Environmental science (n=3), Environmental studies and Public Administration (n=2), among others (see Table 4.5). This analysis only included ISI-indexed journals and books; six items were not published in an ISI-indexed source (see Table 4.5).

**Table 4.5. Subject categories in Journal Citations Report**

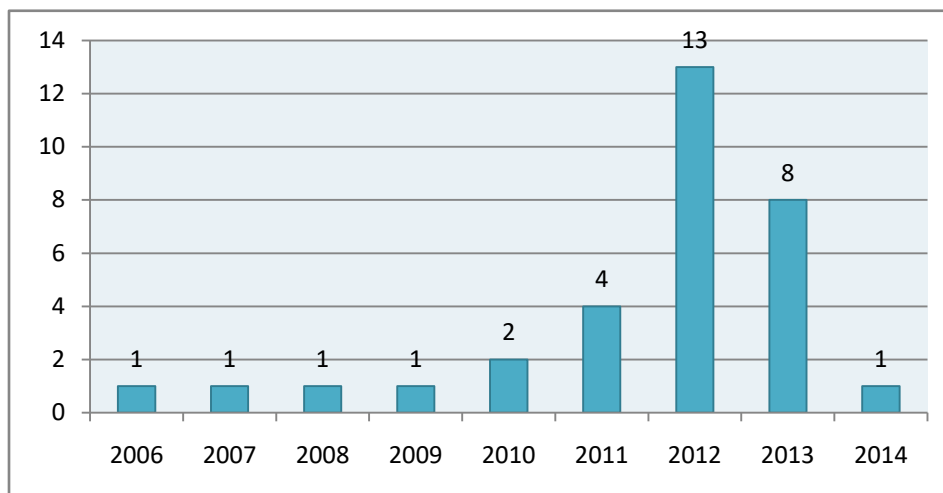
<b>Categories</b>	<b>Total</b>
Agricultural Economics and Policy	7
Environmental Sciences	3
Environmental Studies	3
Environmental Studies; Public Administration	2
Health Policy and Services	1
Ethics	1
Planning and Development; Public Admin.; Social Sciences, Interdisciplinary	1
Engineering, Environmental; Environmental Sciences	1
Geography; Planning and Development; Urban Studies	1
Agronomy	1
Hospitality, Leisure, Sport and Tourism	1
Biodiversity Conservation; Ecology; Environmental Sciences	1
Business; Ethics	1
Environmental Studies; Urban Studies	1
Environmental Studies; International Relations	1
<b>Total</b>	<b>26</b>

Source: own

Regarding the sources that included empirical articles and chapters on wicked sustainability problems, only one journal –*International Food and Agribusiness Management Review*– had more than two empirical articles on wicked problems in the field of sustainability (see Appendix F). Taken together with the aforementioned sources categories, this indicates the spread of academic attention across various disciplines, organizations and policy areas. As can be seen in Figure 4.3, the items focused on the combination of wicked problem and sustainability issues gained particular attention in the last five to ten years [over 78% of the sample was published in 2011 (n=4), 2012 (n=13)

and 2013 (n=8)]. Table 4.6 shows a concentration of research on this particular topic in three countries: 72% of the sample was originated in the Netherlands (n=11), Australia (n=7) and the U.S. (n=5). According to the search process and inclusion criteria defined above, I was unable to find empirical studies on wicked sustainability problems produced by researchers working at Canadian institutions.

**Figure 4.3. Empirical research on wicked sustainability problems by year**



Source: own

**Table 4.6. Empirical research on wicked sustainability problems by country**

Country	Total
Netherlands	11
Australia	7
USA	5
Sweden	1
England	1
Switzerland	1
New Zealand	1
Scotland	1
Wales	1
Australia; China	1
USA; New Zealand	1
Spain; Germany	1
<b>Total</b>	<b>32</b>

Source: own

Finally, the selected empirical sample indicates that 94% (n=30) of the publications used either case study (n=21) or comparative case study (n=9) designs, while the remaining two resources employed either a participatory Q methodology or an action experiment. Overall, most authors preferred a combination of data collection methods and sources, such as interviews, secondary data (public documents, websites, literature), group discussions (e.g., Delphi technique) and participatory and non-participatory observations. As can be seen in Table 4.7, less than 50% (n=15) of selected items did explicitly mention the data analysis strategy applied to conduct the empirical study; in such cases, the authors often used narrative analysis, textual analysis and/or a grounded theory approach.

**Table 4.7 Research methods of empirical resources on wicked sustainability problems\***

<b>Research design</b>	<b>Data Collection</b>	<b>Data Analysis</b>	<b>Authors</b>
<b>Case study</b>	Group discussions	Grounded theory	van Latesteijn and Rabbinge (2012)
	Interviews	Constructive analysis	Weber et al. et al. (2011)
	Interviews + Secondary data	Grounded theory + Actor-Network Theory + Negotiated Order Theory	Schmitt (2011)
	Interviews + Secondary data + Observations (participatory)	Qualitative content analysis + Discourse analysis	Ariza-Montobbio and Farrell (2012)
	Interviews + Secondary data + Observations	Grounded theory	Ozerol et al. (2012)
	Secondary data	Textual analysis	Sandström (2010)
	Secondary data	Content analysis	Gray and Gill (2009)
	Secondary data	Quantitative analysis (regression model)	Hughes et al. (2013)
<b>Comparative Case Study</b>	Interviews + Secondary data	Grounded theory	Woolthuis et al. (2013)
	Interviews + Secondary data + Survey	Content analysis	Cunningham et al. (2012)
	Interviews + Secondary data + Survey + Group discussions?	Narrative analysis	Herrick and Pratt (2012)
	Secondary data	Historic/Longitudinal analysis	Bouma et al. (2011)
	Secondary data	Network analysis + Documentary analysis	Holman (2013)

<b>Q methodology</b>	Interviews + Secondary data + Group discussions	Q analysis	Cuppen (2012)
<b>Action experiments</b>	Group discussions + Secondary data	Multi-stakeholders approach	Andeweg and van Latesteijn (2011)

Source: own

\*See complete list in Appendix G.

## Conceptualization of sustainability

Of the 32 included documents, ten provided a clear conceptualization of sustainability (and/or sustainable development) or mentioned what the term comprises in a specific context or policy area (Table 4.8).

**Table 4.8 Conceptualizations of sustainability in different policy areas**

Context	Definition
<b>Sustainability in water sector</b>	"As Shrivastava and Hart (1995: 163) write, 'sustainability may be more of a journey than a destination: it is a social process requiring continuous capability building and management attention.'" (Herrick and Pratt, 2012)
<b>Energy</b>	"Energy sustainability denotes a set of production and consumption practices assuring that adequate energy will be available for generations to come with limited ecological degradation." (Horiuchi, 2007)
<b>Agriculture</b>	"A dominant view of sustainability in discourses around food and environmental challenges like climate change is that of resource sufficiency. Under this view, sustainability is 'the rate at which resources are being consumed [over a time frame for which] the practice is to be sustained. If current or foreseeable supplies meet or exceed the calculated amount, the practice is sustainable' (Thompson 2010, p. 223). [...] Functional integrity, the capacity of a system to maintain itself without external disruption, is an alternative view of sustainability. Functional integrity emphasizes the systemic relationship of component aspects of an agri-ecological and cultural area to promote regeneration (Thompson and Nardone 1999). Here, policies would tend to emphasize reproducibility of the whole system. (Thompson 2010, p. 229)". (Anthony, 2012)
<b>Environmentally Sustainable</b>	"Many operational definitions of sustainability include simultaneous demands for economic feasibility (profit), benign environmental impact (planet), and enhanced social outcomes (people)—the so-called triple bottom line or 3Ps." (Peterson, 2013).
<b>Environmentally Sustainable</b>	"Transportation that does not endanger public health or ecosystems and meets the needs for access consistent with (a) use

<b>Transportation (EST)</b>	of renewable resources at below their rates of regeneration, and (b) use of non-renewable resources at below the rates of development of renewable substitutes (OECD 1999). This definition takes three aspects of EST into account: public health, ecosystems and natural resources." (Pieters et al., 2012)
<b>Sustainable development</b>	<p>"The most prevalent definition of sustainable development is that of the Bruntland Commission: 'development which meets the needs of the present, without compromising the ability of future generations to meet their own needs' [...] The challenge associated with sustainable development is to preserve the quality of the natural ecosystems while meeting the needs of the various human stakeholders. When considering the aspect of sustainability that concerns the prospects for maintaining a certain anthropogenic system, 'future-proofing' and 'resilience' are often mentioned." (Segrave et al., 2012).</p> <p>"Sustainable development can be defined from the 1987 Our Common Future report as: 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'." (Wilkinson and Mangalagiu, 2012).</p>
<b>Sustainable urban development</b>	<p>"Sustainable urban development requires institutional change, as existing ways to plan and realize buildings and neighbourhoods have to be replaced or supplemented by new institutions that are supportive of sustainable development [...] Sustainable here refers to the way entrepreneurs perceive and frame urban sustainability [...] Zachariassen frames sustainable urban development as completely rethinking the whole value chain of realizing, but also demolishing, buildings. Materials are central to his vision. Materials should be selected and used in such a way that they can be returned to the supplier (reverse logistics), re-cycled, or used as input for another value chain (e.g., as fertilizer)." (Woolthius et al., 2013).</p>
<b>Sustainable urban planning</b>	<p>In the New Zealand context it is important to acknowledge that the long-term view is a deeply entrenched aspect of Maori culture (Loomis, 2000; Jollands and Harmsworth, 2007) and that various iwi (tribes) have put together their own visions of the future (e.g., Ngai Tahu, Ngati Raukawa). [...]</p> <p>"The Mana Whenua view of sustainability is anchored in a world view built on a holistic philosophy that recognizes values and treasures everything's and everyone's interconnectedness. Stories, traditions, philosophies and values passed down from generation to generation underpin this world view. [...] Mana motuhake is the term that best describes Mana Whenua's concept of sustainability, as it focuses on the essence of those relationships between the land, people and atua. It is about self-identity, self-sustainability and self-determination at a whanau, hapu and iwi level. Mana motuhake encompasses creation (mana atua), the land (mana whenua) and the people past-present-future (mana tupuna/mana tangata). The quality and effectiveness of how we care and give</p>

regard to these relationships will determine the quality and effectiveness of sustainable outcomes" (Sustainable Auckland, 2007e, page 35)." (Frame, 2008)

### **Forestry**

"The objective of sustainability is not to win or lose and the intention is not to arrive at a particular point. Planning for sustainability requires explicit accounting of perspective (world-view or mindset) and must be involving of broadly representative stakeholder participation (through dialogue). Success is determined retrospectively, so that the emphasis in planning should be on process and collectively considered, context related progress rather than on achieving remote targets." (Gray and Gill, 2009)

Source: own

As the previous table shows, these definitions differ considerably regarding the variables of sustainability that each author underlines or deems crucial, involving multiple domains, locations and time frames. Using Ostrom's (2009) general framework for analyzing sustainability systems, each description highlights the relevance of different social-ecological subsystems, such as: resource systems (e.g., a neighbourhood, a territory containing forested areas), resource units (e.g., fish, trees, buildings, flow of water), governance systems (e.g., government, community-based, NGOs), and users (e.g., fishers, urban developers, transporters, aboriginal communities). Notwithstanding these differences, most conceptualizations of sustainability underscore the interaction of ecological and anthropogenic systems and the importance of achieving adaptive capacity to guarantee the reproducibility, or at least the availability, of natural resources for future generations. As it is shown below, implicit in these definitions there is a potential tension between long-term ecological goals and short-term economic and political gains. The question of timescale is especially problematic in the case of sustainability issues given the difficulties of balancing the inter-generational timeframes of sustainable development with the short-term imperatives of political and economical cycles (Williams, 2006). As a result of that tension, the achievement of sustainable outcomes based on the respect for environmental constraints may be put at risk.

### **Review synthesis**

This section is dedicated to synthesize the evidence provided by the sampled items using the thematic analysis explained in Chapter 3. The goal is to identify and interpret common themes and patterns, and integrate these findings to answer the review

questions. For each question, the central themes, insights and arguments that recur throughout the literature are presented. It is important to note that the boundaries between themes are relative, and consequently there is some overlap between themes, but for the sake of clarity and simplicity they are presented separately.

### **Review Question #1: What are the main sources of wickedness of sustainability problems?**

Based on the previous mapping exercise, the wicked sustainability problems found in the sampled literature were grouped in ten areas, as shown in Table 4.9. Consistent with Rittel and Webber's definition of wicked problems, every sustainability issue included in the sample is highly context-specific and essentially unique. There are no studies analyzing the same sustainability problem in the same policy area and/or context, which contributes to the aforementioned lack of cumulative knowledge in this field of research.

**Table 4.9 Sampled wicked sustainability problems**

<b>Sustainability (Area)</b>	<b>Wicked Problems</b>	<b>Authors</b>
Agricultural Sustainability	Environmental sustainability	Hospes et al., van der Valk and van der Mheen-Sluijer (2012)
	Sustainable agricultural development and food security	van Latesteijn and Rabbinge (2012)
	Sustainable development in agriculture	Andeweg and van Latesteijn (2011)
	Sustainable transportation	Pieters, Glockner, Omta and Weijers (2012)
	The intersection of food security and climate change	Anthony (2011)
	Wicked problems associated with sustainable development	Bouma et al. (2011)
	The negative impact of irrigated agriculture on environmental sustainability	Ozerol, Bressers and Coenen (2012)
Urban Sustainability	Sustainable urban development	Woolthuis et al. (2013)
	Planning for housing development	Adams (2011)
	Sustainability issues ("unsustainability")	Gollagher and Hartz-Karp (2013)
	Sustainable urban planning	Frame (2008)
	Urban and transnational problems	Acuto (2012)
	Wicked issues in local areas	Holman (2013)
	Ecological and social issues	Schmitt (2010)
	Environmental sustainability	Cuppen (2012)
	Social sustainability for communities hosting mining operations (Mining development problems)	Everingham (2012)

Energy Sustainability	Sustainable energy policy implementation	Horiuchi (2007)
	Wind energy siting (i.e., where to site wind farms)	Ariza-Montobbio and Farrell (2012)
	Promoting sustainability by boosting projects enhancing biomass utilization	Wubben and Nuhoff-Isakhanyan (2013)
Water Sustainability	The 'science impasse' in water resources and associated water management issues	Weber, Memon and Painter (2011)
	Water management for current and future social and ecological sustainability	Allan (2012)
	Water sector sustainability	Herrick and Pratt (2012)
	Watershed problems (sustainable watershed management)	Segrave, Buscher and Frijns (2012)
Food System Sustainability	Animal welfare in food production	Bos, Blok and van Tulder (2013)
	Problems affecting sustainability in the mainstream food system	Hamilton (2013)
Ocean and Coastal Sustainability	Lack of adaptability in fish stocking policy	Sandström (2010)
	Preserving reefs while promoting human development and nation building	Hughes, Hui Huang and Young (2013)
Sustainable Development	Sustainable natural resource management	Peterson (2013)
	Governance of sustainable development	Williams (2006)
Sustainable Health Care Provision	Wicked problems in healthcare	Cunningham et al. (2012)
Sustainable Forestry	Forestry issues (Natural resource management problems)	Gray and Gill (2009)
Sustainable Tourism	Sustainable tourism activities	Scherrer and Doohan (2014)

Source: own

Notwithstanding the uniqueness of every wicked problem reviewed, finding a common set of potentially relevant relationships and variables (i.e., patterns and configurations) is still critical for building a general framework on the wickedness of sustainability problems. The intention for this framework is to be robust and theoretically well founded, but also flexible and simple enough to be used in the design of data collection instruments, the conduct of fieldwork, and the analysis of findings in the remaining chapters.

Five major themes have been found recurrently in the literature reviewed as the main factors that make a policy problem wicked in the field of sustainable development: lack

of consensus (i.e., conflicting notions of a wicked sustainability problem); uncertainty; complexity; dynamism; and sustainable solutions as wicked problems (what I call here *wicked solutions*).

Theme 1.1: Conflicting notions/Lack of consensus

Throughout the reviewed literature the most salient aspect of a wicked sustainability problem is the lack of consensus on how the issue is defined and comprehend by implicated coalitions of stakeholders with divergent belief systems, cultural values and epistemologies that form those beliefs. A stakeholder can be broadly defined here as “someone involved in, affected by, knowledgeable of, or having relevant expertise or experience on the issue at stake” (Cuppen, 2012:24).

Sandström (2010) attributes this particular wicked feature of sustainability problems to substantial uncertainty, in other words, the existence of different belief coalitions in the policy subsystem, each with a particular notion of the problem. How the coalitions are structured affects the framing of a common view of the problem and, eventually, the results of policy-making processes. In the case of fish stocking policymaking, Sandström highlights other sources of substantial uncertainty: the coexistence of current positive economic effects on fisheries and possible negative ecological consequences in the long-term, and the use of ambiguous concepts and inconsistent terminology around sustainability issues. This last feature has also been underscored by Anthony (2012) in the case of agricultural sustainability, Bouma et al. (2011) in terms of sustainable development, and Woolthius et al. (2013) in relation to sustainable urban planning.

In the field of water sustainability, Weber et al. (2011) also stress the relevance of competing coalitions with divergent analytical approaches to problem solving, different perceptions of uncertainties and risks, and how they use those perceptions to boost their preferred policy image or to challenge a policy image of a rival coalition. Weber and his colleagues argue that any strategy that achieves sustainability over the long term necessarily needs more than just “getting the science right” in order to come up with a common view of the problem. It has to include also the social dynamic of economics and political-legal settings, and promote learning processes to reinforce beliefs within coalitions and among coalitions with similar analytical approaches. In the case of housing development, Adams (2011) also advocates a mutual learning approach to deal with the

*elusiveness* of housing land supply. The author uses this term to refer to "the uncertainty around whether the problem is really about land shortages, low rates of production or house price inflation, or some combination of these three" (Adams, 2011: 958). He understands this particular issue not essentially as a clash of techniques or methodologies to secure consensus around long-term development targets and/or short-term progress, but as an acute divergence of values and interests between relevant stakeholders, especially between those who see exchange value in a natural resource (in this case, land) and those who emphasize its environmental value.

In Indigenous contexts in particular, divergence in stakeholders' belief systems is conceived of as a clash of two world-views: the Western versus the Aboriginal perspectives on the commons; in other words, the separation of nature and human, and the viewing of resources as "pre-existing substances or things" rather than in terms of "functions and relationships". This is mainly reflected in differing conceptions and notions of harm, risk and the presence of uncertainty, varying accounts of sustainability, and competing ethical frameworks. This clash has usually resulted in a favoured weighting of western over Aboriginal value and knowledge systems, and the creation of ontological barriers between participants in negotiations and discussions on natural resource management (Scherrer and Doohan, 2014). Other related consequences are the dismissal of non-scientific indigenous knowledge and value-based lay expertise, and "moral and epistemological conundrums" that determine the moral status of a particular (wicked) problem and the decision-making mechanisms and processes that result in policies, laws or regulations (Anthony, 2012).

### Theme 1.2: Uncertainty

The term *uncertainty* is recurrently used to define wicked sustainability problems; however, it may acquire different meanings depending on the context where it is applied. At the same time, different types of uncertainties may coexist in a particular context. In fish stocking policy, for instance, Sandström indicates that three types of uncertainties characterize wicked problems: the aforementioned substantial uncertainty (i.e., what the substance of the problem is), strategic uncertainty (i.e., what the strategies and actions of other actors are), and institutional uncertainty (i.e., how the overall institutions will govern the processes). The simultaneous presence of different types of uncertainties

complicates the different stages of environmental policy making and explains in part the gap between scientific knowledge and practice.

Similarly, Weber et al. (2011) identify three different sources of uncertainties related to wicked problems. In addition to the human-stakeholder relationships (i.e., social uncertainty) and the results of policy and planning processes (i.e., political uncertainty), they highlight the presence of scientific uncertainty. This is mainly related to how natural resource sciences tries to model and understand biophysical relationships and predict outcomes across a full spectrum of interconnected issues. Likewise, Anthony (2012) underscore two main types of uncertainty –objective and subjective– that frame the discourses on food security and climate change, especially around scientific uncertainty and risk. Using Pielke's (2007) terms, Anthony (2012) refers to scientific (objective) uncertainty as the lack of complete and accurate characterization of the entire set of outcomes associated with a particular set of expectations. Moral (subjective) uncertainty, by contrast, refers to our judgments about how to value the entire set of outcomes associated with a particular set of expectations, especially when more than one outcome may be consistent with our expectations. These two types of uncertainty produce competing senses of risk surrounding wicked problems. On the one hand, a probabilistic or expected utility model, which is mainly preferred by policymakers and scientists, understands risk as a product of the likelihood of a harmful outcome resulting and its magnitude. On the other hand, there is a laypeople view of risk where the public conception is more varied and connected to trust, control and feelings of well-being (Anthony, 2012). As observed by Cuppen (2012) though the distinction between *experts* and *laypeople* –and the attribution of technical expertise to one domain and values and preferences to the other– reflect a perception of certainty on the relevant expertise for dealing with the problem, which actually does not seem to exist.

### Theme 1.3: Complexity

Wicked problems are embedded in a multi-level governance system covering different policy areas, jurisdictions, institutions, and levels of government (Williams, 2006; Gray and Gill, 2009; Sandström, 2010; Scherrer and Doohan, 2014). In this sense, the idea of complexity is mainly related to institutional challenges for the achievement of adaptive responses across both vertical and horizontal sectors of governance within and outside

government organizations, where responsibility is widely spread and dissected. An institutionally complex problem makes it difficult to determine exactly what the problem is and the party responsible for the solution (Sandström, 2010; Scherrer and Doohan, 2014).

Horizontal institutional complexity is increased by the fact that many non-governmental organizations, coupled with conflicting interests and demands, are involved in policy making processes (Sandström, 2010; Pieters et al., 2012). According to Williams (2006), non-linear, complex relationships and interdependences of social, economic, environmental and political systems within multi-organizational and stakeholder environments are complicated or impossible to predict given that outcomes can be disjointed from inputs. This means, for example, that small interventions can sometimes elicit a major response, while major policy interventions may perversely have little major impact.

In terms of vertical complexity, Gray and Gill (2009), Schmitt (2010), Herrick and Pratt (2012), Gollagher and Hartz-Karp (2013) and Woolthius et al. (2013) coincide in that the existing rigidly structured civic and governmental institutions severely constrain the efforts to devise and implement effective responses to complex socio-ecological problem. Current institutional arrangements and processes are generally inadequate to address "the complexity of interacting 'loops' of positive and negative feedback relationships" that are at play (Gray and Gill, 2009: 88). Current institutional arrangements tend to inhibit the open flow of information needed to stay abreast of the changing conditions of a wicked situation. As a consequence, there are disconnections between siloed institutions and lack of collaboration between the community, government, non-government organizations and the private sector, which continue to be major barriers to implementing joint solutions. In this regard, Scherrer and Doohan (2014) highlight two other factors that contribute to the relentless nature of wicked problems: first, the risk averse intolerance of messy collaborative processes in the public sector and, second, the deliberate exclusion of beyond-boundary issues in bureaucratic structures and government agencies.

#### Theme 1.4: Dynamism

The term *dynamism* (and/or *dynamic*) has been recurrently used in the selected literature to depict an integral part of wicked phenomena. It mainly refers to how fast constraints and available resources change over time (Bouma et al., 2011), and/or the continuous change of economic and social demands for goods and services along with policy goals and political actors (Weber et al., 2011; Adams, 2011). Let's think, for example, on how the public view on, and treatment to, water has changed from a “commodity” only trough to an “essential resource” in maintaining and sustaining communities, peoples, and nature (Weber et al., 2011). In the case of urban sustainability, Acuto (2012) attributes this ever-changing aspect of wicked issues not simply to conditions originated exogenously (due to global flows) or endogenously (due to internal social phenomena), but to an evolving restructuration between the exogenous and the endogenous environments. In the same policy area, the dynamic aspect of sustainability issues was also previously underscored by Frame (2008) who indicated that the inherent messiness of wicked problem-solving processes is affected by internal and external future events that influence the extent to which the problems (and the sustainable solutions) remains current and the form that they will take.

One of the main consequences of this continuous change of facts that describe contemporary sustainability problems it is that we simply cannot know what all those facts are or possess the require knowledge to provide straightforward answers. Therefore, it is impossible for a single institution and/or expert to be in charge of the substantive problems that require resolution or to make predictions on its outcomes (Schmitt, 2010; Bouma et al., 2011, Scherrer and Doohan , 2014).

#### Theme 1.5: Sustainable solutions as wicked problems (“wicked solutions”)

Several authors have indicated that a main source of wickedness of social-ecological sustainability problems is the fact that problem-solving and planning processes for sustainable development are themselves wicked problems. Adams (2011), for instance, argues that planning for housing development should be regarded as a wicked problem in the sense that it is indeed characterized by “elusiveness, subjectivity, uniqueness and complexity” (p. 952). In this case, the wicked nature of aiming for sustainable development is found in the difficulties of predicting planning outcomes and the short

shelf life of perceived solutions in a dynamic context characterized by constant local twists in market conditions, political alliances and stakeholders. Additionally, Adams underscores the ambiguous nature of the planning system itself that, while seeking to influence market outcomes (e.g., the location of housing development), remains heavily reliant on the initiative of market actors for the delivery of important public policy goals (e.g., increased homeowners).

In the field of water sustainability, Segrave et al. (2012) indicate another inherent ambiguity of sustainable solutions: contrary to the wicked nature of sustainability problems, current (watershed) management and planning processes usually frame problems resting on presumed certainties and knowledge of initial conditions to make probabilistic predictions using deterministic models. As previously explained, though, transitions in natural systems affected by wicked problems are mostly nonlinear and characterized by irreversible tipping points. The problem framing process –probably the most crucial phase in planning adaptation to contextual change– is thus surrounded by uncertainties and lack knowledge about initial conditions and future consequences. Segrave and his colleagues underscore that the interdependence between social-ecological variables and the apparent lack of causal connections among them place the planning system for sustainable development under high pressure.

In the same policy field, Allan (2012) attributes the unsuitability of management and planning systems to the use of projects as solutions to tackle wicked problems. The author stresses that the use of projects is merely habitual, unreflective, and a residue of the transition from the conventional command-and-control toolkit to a new problem-solving paradigm. According to Allan (2012), the idea of projects seen as *solutions* perpetuates the tensions between the normative idealistic approach (integrative, adaptive, systemic, participatory, democratic, power sharing) and the critical realist approach (top-down, mechanistic, command and control, power concentration). Moreover, it has to be considered that sustainable development strategies have very long-term, unforeseeable consequences that go beyond a single project, region or time (Schmitt, 2010).

Other authors focus their critiques to extant management and planning systems on the implementation phase of sustainable solutions (Bouma et al., 2011; Anthony, 2012; Scherrer and Doohan, 2014). In different policy areas, those studies highlight how

implementing responses to a wicked problem creates many other wicked problems –even when there is a consensus on the solution to apply or a successful resolution of one aspect of the problem– as interests involved are quite diverse, originating in different worlds of perception.

**Review Question #2: What are the problem-solving strategies that have been proven successful to tame wicked sustainability problems?**

What follows are four strategies that most frequently appear in the reviewed literature as successful problem-solving processes to wicked sustainability problems from an integrative, comprehensive perspective: system innovation; network-based/collaborative governance; adaptive management; and multi-stakeholder engagement. Their meanings, advantages, and factors and conditions that increase and/or decrease their chances of success are presented below.

Theme 2.1: System innovation

System innovation refers to an “executable and replicable way of setting up an innovation trajectory in a situation where the underlying wicked problem (in this case sustainable development) does not allow for more traditional ways of executing a more standard project approach” (Andeweg and van Latesteijn, 2011: 138). It is a new way of doing things that can lead to new and improved configurations with the surrounding physical and social environment (Bouma et al., 2011). From this perspective, this is a systemic endeavour because the public and private sectors top management can no longer be the sole source of innovation; it must emanate from all levels (Herrick and Pratt, 2012).

System innovation is seen as the result of a creative and collaborative process with outcomes beyond what is currently known, based on new modes of production and institutional arrangements that allow for these new modes of production to flourish. Using the Transform model as a guideline to manage wicked problems in agriculture, Andeweg and van Latesteijn (2011) and van Latesteijn and Rabbinge (2012) agree on five principles that characterize system innovation: 1) sustainable development is a dynamic process; 2) sustainable development needs system innovation; 3) system innovation is a non-linear learning process, 4) system innovation needs active engagement of knowledge institutes, governments, civil society organizations and

businesses (also known as 'multi-stakeholder approach'), 5) multi-stakeholder approaches imply trans-disciplinary collaboration and co-creation of knowledge.

*Success factors:*

At least the following two main underlying and interrelated strategies have to be in place for a system innovation process to be successful: (i) horizontal trans-disciplinary collaboration, (ii) multi-stakeholder partnerships.

(i) Trans-disciplinary cooperation among higher education institutions, entrepreneurs, civil society organizations and government —each with different interests, goals, and value judgments— is critical to develop new modes of production and effective responses to wicked problems. From this perspective, cooperation across coalitions of stakeholders will coincide with cooperation across different analytical methods of inquiry (Weber et al., 2011). The expected result of such interdisciplinary cooperation is the development of problem solving strategies and processes that make use of a diversity of perspectives and understandings at hand, and integrate universal (scientific) knowledge with local knowledge (i.e., practical wisdom' of ordinary people) particularly relevant to the social, ecological, and historical circumstances (Weber et al., 2011; Segrave et al. 2012; Gollagher and Hartz-Karp, 2013).

Using the words of Van Latesteijn and Rabbinge (2012), transdisciplinary cooperation in the agricultural sector contributes to *sustainable valorization*, which illustrates the cooperation among new partners to open up existing markets by translating values related to sustainable development into visible product characteristics. In this same field, Bouma et al. (2011) propose a three-phase process of *connected value development* (value-proposition, value-creation and value-capture), where local and national actors are involved early in the process as co-developers of ideas helping knowledge-driven inventions to flourish. In a nutshell, the value proposition step serves to define a common solution to the different goals. In this first phase, it is important to assemble the right parties at the start of the process recognizing that a combination of various types of knowledge is essential for solving wicked problems. Value-creation involves integration of different types of hard and soft data and information into a coherent operational design, in which implicated partners connect with government and other organizations to develop new institutional structures that support value capture in the end. The value-

capture phase represents the successful completion of the innovation process reflected in the contribution of science to societal development, and in the co-creation of system innovations that lead to new modes of production.

This intersectional innovation process is based on a new type of knowledge production where multiple stakeholders bring together a great variety of skills and capabilities in order to create or construct knowledge transgressing boundaries between disciplines and fields of expertise (Andeweg and van Latesteijn, 2011). In this sense, there seems to be an agreement on that inventions generated by scientific research are an essential but not exclusive ingredient to achieve innovation in the context of sustainable development (Bouma et al., 2011; Weber et al., 2011).

(ii) System innovation is directly related to the creation of partnerships as an effective way to promoting and stimulating co-creation of knowledge among higher education institutions and other social actors (Van Latesteijn et al., 2012). Partnership-based strategies provide opportunities for diverse stakeholders working on sustainability to meet, learn, and support each other in becoming better leaders for change in their organizations and in the larger system (Hamilton, 2013). “New partnerships need to be brokered and innovative processes need to be developed to counter current unsustainable practices,” proposes Frame (2008: 25) in support of the development of long-term sustainability frameworks. But for partnerships to be an effective strategy to achieve system innovation, they require the following: the sharing of local knowledge, better resource efficiency, competitive advantage and higher levels of social cohesion (Holman, 2013), symmetrical relations between different sectors to collaboratively address the wicked problem at hand (Everingham, 2012), and flexibility of all partners to adhere to non-familiar methods, instruments and procedures with an open attitude to learning (Bouma et al., 2011). Andeweg and van Latesteijn (2011) and Van Latesteijn and Rabbinge (2012) also highlight the importance of developing a shared vision among partners and a clear monitoring process to keep track of the various value orientations and regularly calibrate the partners' bases for cooperation.

*Challenges:*

One of the main obstacles to system innovation —and for engaging a variety of stakeholders in such process— is the fact that autonomous actual consumer demand for

innovative sustainable products and services is currently too weak to drive sustainable development at the speed that is needed on a commercial basis only (Andeweg and van Latesteijn, 2011). In the case of food security, for instance, this is reflected in corporate agendas mainly focused on globally traded commodities and processed food with high revenue margins, rather than innovation in community-based food systems and nutrition that would bring healthy alternatives to consumer markets (Hamilton, 2013).

Another related problem is that the engagement and trans-disciplinary collaboration among stakeholders are *per se* difficult processes. As indicated by Bouma et al. (2011), many scientific disciplines are involved in the study of wicked problems of sustainable development, but combining essentially separate vertical research efforts of different disciplines is quite difficult. In part, this is explained by the lack of additional value indicators for horizontal, collaborative research as compared with the classical vertical approach, and the indiscriminate application of value criteria for basic research to horizontal approaches. Andeweg and van Latesteijn (2011) and Bouma et al. (2011) agree on two additional challenges. First, research inventions do not contribute to societal developments when presented in isolation because there is no co-creation of system innovations that lead to new modes of production. Second, a lot more needs to be done with respect to the engagement of the research community within and outside the academia. As observed by Andeweg and van Latesteijn (2011: 144), “we are only beginning to understand the intrinsic delicacies of innovation processes in situations where values, beliefs and stakes are widely differing.”

### Theme 2.2: Network-based/collaborative governance

Acknowledging that the public sector or any other participating stakeholders alone is no longer capable of tackling complex policy issues by itself, there is a strong consensus in the reviewed literature on that new approaches to collaborative, participative governance are needed to effectively address wicked sustainability problems. The development of partnerships, power sharing and extensive operational collaboration with a variety of stakeholders are critical in this regard (Acuto, 2012; Herrick and Pratt, 2012; Hospes et al., 2012; van Latesteijn and Rabbinge, 2012; Schimtt, 2010; Bouma et al., 2011).

The term *network* recurrently appears in the literature as a synonym for partnership, collaboration and alliance, which describe new interactions between people, groups, organizations and governments based on repeated, enduring exchange relationships between participating actors (Cunningham et al., 2012). In this regard, for instance, Schmitt (2010: 11) argues that creating “more stakeholder democracy in the sense of more self-governance and voluntarism” helps to engage multi-stakeholders in long-term projects with high environmental impacts. In a similar vein, but in the field of agriculture, Bouma et al. (2011) advocate for a *horizontal self-governance approach* (e.g., farmers’ cooperative) that based on clear and transparent environmental guidelines, rules and regulations motivate farmers to follow alternative production procedures and to introduce a variety of product-market combinations leading to higher future income. In the area of water resource management, Weber et al. (2011) also propose networked, collaborative governance processes to link sound scientific analysis with effective public deliberation by putting the emphasis on conflict resolution processes, inclusiveness and information sharing among public and private governing structures.

Analyzing wicked problems in the field of sustainable urban development, Holman (2013) argues that *partnership governance* is an effective strategy to avoid some of the problems associated with collaborative work, namely: resource costs, lack of participatory, and accountability. Similarly, Everingham (2012) sees partnerships between state and local governments, industry and community as an effective policy response that embraces more disperse authority and action, and supports new forms of cooperation to deal with the social impacts of mining in Australia (i.e., housing and accommodation). Finally, Gollagher and Hartz-Karp (2013) uses the term *deliberative collaborative governance* (DCG) to refer to institutional arrangements where decision-making authority is shared among diverse stakeholders (along with their perspectives and resources) and various forms of shared responsibility, authority and power exceed the problem-solving capacities of existing institutions. DCG may not include the government as a stakeholder and it can be implemented when government has failed to deal with an issue satisfactorily, when government policy is deficient, when state-supported governance is limited or non-existent, or when government is not relevant to the task. According to Gollagher and Hartz-Karp (2013: 2348-9), deliberative collaborative

governance is “any policy-making procedure or process in which (1) ‘ordinary citizens’ participate (along with other stakeholding groups) in collaboratively performing tasks such as setting priorities, crafting or analysing policy proposals, devising plans, and recommending actions; (2) participants deliberate together concerning options for action or policy adoption; and (3) the public’s role is that of a full partner with influence sufficient to secure positive responses from the other stakeholders.”

The emergence of forms of network governance and collaborative relationships between different interests that help moving communities toward sustainability are compatible with principles of deliberative democracy and collaborative governance, devolved governance and decentralization of services (Cunningham et al., 2012; Williams, 2006; Gollagher and Hartz-Karp, 2013). The normative goals of this problem-solving orientation are related to enhanced social learning, efficient use of resources, increased capacity to plan for and address complex problems, greater competitiveness, better services for clients and customers, and the possibility of meeting instrumental goals while pursuing collaborative interests.

*Success factors:*

First of all, for network- and partnership-based governance to be effective, sustainable development principles need to be embedded or mainstreamed into the policy-making process at all its stages through the integration of policies and strategic areas within a coherent framework (Williams, 2006; Holman, 2013). Empirical cases demonstrate that more coherent natural resource management regimes –which incorporate institutional complexity through productive combinations of goals, capacities, experiences, information and power– bring about more sustainable natural resource use (Ozerol et al., 2012), strengthen regional strategic planning, and coordinate the proliferation of activities and plans at various levels (Everingham, 2012). Setting a coherent framework is important to establishing policy priorities and specific political arrangements at a high institutional level to promote horizontal integration through: encouraging the creation of new boundary-spanning roles and functions; designing and sponsoring new organizations; identifying appropriate lead organizations to coordinate other partners; and generating visions and images that can transcend different policy fields (Williams, 2006).

*Integration* in natural resource governance refers to problem-solving approaches (e.g., integrated water resource management) that enable the recognition of political, social and ecological factors by emphasizing broad stakeholder participation in planning and implementation of policies (Ozerol et al., 2012; Holman, 2013). Ozerol et al. (2012: 59) introduce the concept of *cross-sectoral alignment* to refer to “the relative positioning of multiple policy sectors conducive to sustainable governance of natural resources.” According to those authors, the relative positioning indicates the manifestations of the governance sub-system of each policy sector in terms of their actors, levels, instruments and processes. Conduciveness refers to the alignment of policy sectors through having similar positions in terms of their governance sub-systems. Based on these definitions, it is possible to identify a clear overlap between the conceptualization of conduciveness proposed by Ozerol et al. and the coherence criterion of integration indicated above.

Second, broad participation of, and collaboration between, governments, non-government organizations, the private sector, and civil society is needed to usher the knowledge, experience, information, resources, and readiness to share responsibility, authority and power in a partnership-based governance system. In this regard, successful partnerships involve many centres of power at every conceivable scale, innovative formal and informal arrangements, and a collaborative process of deliberation to identify and weigh policy options with a view to establishing priorities and articulating a direction for action. This process has to be based on a participatory form of democracy that assigns to ordinary citizens the role of identifying and weighing policy options, establishing priorities, and articulating a direction for action on the part of both government and the community (Gollagher and Hartz-Karp, 2013).

Third, to be successful in terms of relationship building and knowledge transfer, partnerships need also to develop bonds of trust, norms, values and institutional practices within current governing structures to allow the embedding of partnerships within broader local governance decision structures. As shown by Holman (2013) in the case of urban partnerships, this requires clarity of objectives, policy integration and consideration about how new partnerships fit into the overall matrix of local governing and extant networks. Partnership interconnectivity is needed to build bonds of trust and norms that then are translated into mutually held strategic policy aims (Holman, 2013).

Fourth, a focus on implementation and service delivery is also critical for the emergence of collaborative relationships and partnerships, and to encouraged network partners to embrace sustainable development policies (Williams, 2006; Wubben and Nuhoff-Isakhanyan, 2012). Self-organization (bottom-up) by the interested parties, together with professional management support and coaching, promote an orientation on delivery and implementation and prevent network fragmentation by orienting partners towards strategic interests (Wubben and Nuhoff-Isakhanyan, 2012; Cunningham et al., 2012).

Finally, Cunningham et al. (2012: 3) highlight the importance of stable professionalized leadership, “as an alternative organizational core to one based on fragile general managerial roles.” What the authors recommend in this regard it is a distributed leadership model with a collaborative and inclusive style, and a structure of working groups led by expert network members with responsibility to develop specific cooperation agreements.

*Challenges:*

The rise and development of network governance and partnerships as solutions to wicked problems have neither been easy nor uncontroversial. One of the main challenges associated to this approach is the lack of strong evidence about how these solutions might be built into a number of policy actions (Williams, 2006). As noted also by several authors, the claims for the effectiveness of networks and partnerships to deal with wicked sustainability problems tend to be theoretical and/or conceptual rather than empirical (Gollagher and Hartz-Karp, 2013; Holman, 2013; Cunningham et al., 2012; Hospes et al., 2012). As a consequence, there is a considerable discrepancy between the acclamation and attention networks receive in the literature, and the lack of empirical knowledge and understanding of the processes and dynamics of partnerships and networks' overall functioning (e.g., the process by which certain network conditions lead to various network-level outcomes). The literature also shows a strong bias that tends to conceive partnerships and networks as naturally better, or even ideal, and certainly more promising forms of governance, without paying attention to the complex reality where such solutions have to be embedded (Hospes et al., 2012; Holman, 2013). Uncritically asserting that partnership-based governance will automatically create the conditions,

synergies and resources that promote sustainability, however, poses the risk of having a number of fragile partnership arrangements, detached from existing governance structures (Williams, 2006; Holman, 2013). It ignores also that such governance arrangements may be the breeding ground of wicked problems without a clear agreement on the problem statement, solution or supreme authority (Hospes et al., 2012).

Another critical challenge for network governance for sustainable development is the fact that the coherent integration of policies is problematical, if not a wicked problem itself, given the diversity of implicated stakeholders (e.g., business, civil society, government actors), each of them having missions, interests and values that may be hard to reconcile. A variety of obstacles to effective policy integration are discussed in the reviewed literature. Williams (2006), for instance, highlights: the conceptual diversity over the meanings of sustainable development (and/or sustainability); incompatible accountability frameworks; inappropriate or absent leadership; insufficient boundary-spanning capacity; inappropriate configuration of responsibilities; poor collaborative cultures; lack of competency of managing within forms of inter-organizational relationships; and an absence of integrative frameworks to connect policy formulation with effective delivery. Other authors focus on the rivalry and competency among global, national, regional networks, coalitions or alliances all claiming status in particular policy areas (Hospes et al., 2012); lack of innovative leadership (Hughes et al., 2013); different temporal objectives that can be impossible to reach under limited financial, physical and human resources (Ozerol et al., 2012); insufficient funding opportunities (Cunningham et al., 2012; Wubben and Nuhoff-Isakhanyan, 2013); fundamental spatial and political disparities (Wubben and Nuhoff-Isakhanyan, 2013); partnership fatigue and lack of interconnectivity that lead to the creation of networks where information is not shared fully and common economic interests are hard to agree (Holman, 2013).

### Theme 2.3: Adaptive management

Wicked sustainability problems defy resource governance systems and reveal their need to adapt in order to cope with multiple pressing stresses and deliver sustainable solutions. Adaptive management approaches are being adopted in different policy areas to make proactive adjustments to existing managerial instruments and involve a variety of stakeholders to address a wicked sustainability problem. The concept *adaptive*

*management* has different connotations in the reviewed literature, all using variations on the theme of facilitating purposeful learning across and within diverse social groups (i.e., social learning) for improved action, such as changed practices, changed expectations, or both. In the case of the lack of adaptability in fish stocking policy as a wicked problem, Sandström (2010) conceives of adaptive management as a continuous, circular learning process in which management rules and regulations are constantly revised to accommodate new ecological (scientific) knowledge. The integration of both local knowledge and scientific knowledge, and change are key concepts within the adaptive management approach (Sandström, 2010).

In the water sector, Herrick and Pratt (2012) advocate for an adaptive and flexible management approach to accelerate the learning cycle in order to enable a rapid assessment and implementation of the consequences of new insights, and reduce the uncertainty and complexity associated with wicked problems. Integrated water resource management, for instance, is a response to current acknowledgement of the complexity and wickedness of water management, which enables appropriate responses via multi-party participation (Allan, 2012). In this case, adaptive management is seen as a useful tool for policy integration as it provides a framework to enable participatory processes and social learning that contribute to changed policies and practices. Finally, analyzing wicked problems related to sustainable urban development, both Frame (2008) and Everingham (2012) highlight the importance of adaptive management through continuous reflexive learning, recognition of expertise from multiple sources, and the incorporation of different and potentially conflicting values and interests in the decision making process.

*Success factors:*

Cross-boundary policy learning is considered a prerequisite for adaptive policy making and effective policy integration. This entails, in other words, a learning process across belief coalitions on various levels and in different policy sectors, which allows them to exchange world views, gain insight into their environmental circumstances, formulate a common notion of the problem and, eventually, improve the management of human and environmental interrelations (Sandström, 2010; Segrave et al., 2012). From this perspective, social learning is generally associated with systems thinking and a reflexive

approach, with a particular emphasis on co-learning, whereby individuals collectively develop new knowledge by making use of the diversity of perspectives and understandings at hand (Segrave et al., 2012).

Sandström (2010) suggests that the required interaction and communication between stakeholders to make social learning possible can be organized through the establishment of boundary organizations, the institutionalization of stakeholder involvement, and formal partnerships of stakeholders, policy makers and scientists. Other factors that explain the success of adaptive management to address wicked sustainability problems include: leaders who are reflective and capable of action-oriented learning (Herrick and Pratt, 2012); building long-term trust among coalitions to facilitate systemic practice, integrative ways of working, and learning across and within diverse social groups (Allan, 2012; Everingham, 2012); the structure of the collaboration networks and processes (agreed strategies, roles and responsibilities), and their level of conflict and distribution of power (Sandström, 2010; Everingham, 2012). Tolerance of uncertainty, ambiguity and diversity of knowledge and values, along with flexibility of multi-sectoral, collaborative strategies are also important to harness such diversity and integrate social, environmental and economic considerations at the local and regional level (Everingham, 2012).

*Challenges:*

One of the main challenges for adaptive management of sustainability issues is that in adaptive circles there is no straightforward link between scientific knowledge, policy and policy outcome. This problematic aspect is particularly hard to solve considering the inherent uncertainties and institutional complexity surrounding wicked sustainability issues that span time, ecosystems, administrative jurisdictions, belief coalitions and institutional borders. As a consequence, there are constant tensions between short-term and long-term goals, and between economic values and ecological values, as well as implementation failures and lack of policy adaptability (Sandström, 2010).

In the case of water management for current and future social and ecological sustainability, Allan (2012) has also observed deeply entrenched institutional constraints that pose obstacles to move from conventional to adaptive management: for instance, inappropriate temporal and physical boundaries, and societal/cultural preferences for activity over reflection, auditing over learning, and competition over cooperation. As in

the case of system innovation, Allan focuses more specifically on the uncritical use of projects for sustainable purposes, “a consequence of, and support for, a way of thinking which is mechanistic and unsuitable for tackling wicked problems” (2012: 238).

According to that author, the short-time frames of projects in natural resource management limit the potential for the needed identification of all stakeholders, and their meaningful participation in contextualization, planning, action and learning activities. Projects also allow only limited time for trust to be nurtured and developed among stakeholders, stimulate definitions of wicked issues in terms that fit within the project – rather than in terms that fit the issue–, and reduce complex, interrelated systems to a size and simplicity that can be managed within the project. Projects constrain the potential for learning because the information and understanding within the project community will stay within that community unless mechanisms for reporting and sharing are developed and used, and trusting relationships are formed. Valuable information and knowledge may also be lost from the project area when temporary project staff moves onto their next assignment. The possibility for new understandings to be incorporated into participatory planning activities, as per an adaptive approach, may be limited by the project boundaries and the imperative to deliver the desired outputs and meet fixed targets. Although this outcome-based approach lends projects to internal accountancy and auditing, it does not necessarily foster systemic learning, particularly in situations of high uncertainty and/or ecological dynamism (Allan, 2012).

Last, but not least, strategies for transitioning to more sustainable development in different fields require new relationships between public organizations and private sector actors who are called to adopt more sophisticated forms of corporate social responsibility or corporate citizenship. Examples of the same are diverse stakeholders enacting civic responsibilities to participate in governance, complement public sector capacities and add public value (Everingham, 2012). However, as noted by that author in the case of sustainable mining development, symmetrical relations between different sectors to collaboratively address a wicked problem are particularly problematic for companies whose narrow conception of corporate social responsibility do not encompassed public participation in regional governance institutions. As a consequence, there is often a lack of balance of contradictory values, and weak development of trust among implicated

organizations and across sectors that are necessary for integrative ways of working in adaptive policy cycles.

Theme 2.4: Multi-stakeholder engagement

The engagement of “unlikely allies” (Andeweg and van Latesteijn, 2011; Van Latesteijn and Rabbinge, 2012) is key to achieve results that never would have been developed by either of the implicated parties individually. Multi-stakeholder engagement (MSE) is a process based on mutual understanding and co-creation of solutions that can lead to shared responsibility, system innovation, and social learning based on a less ordered and structured management approach (Peterson, 2013). As explained by that author, the term *engagement* is key here—rather than participation, collaboration, cooperation or any other form of standard group process—because it means that stakeholders move beyond conflict and compromise to co-creation, learning and action. Among other things, engagement implies the designation of different roles and responsibilities to the various participants along the different phases of the innovation process, as well as giving room for changes in roles and responsibilities over time (Andeweg and van Latesteijn, 2011). Thus, MSE favours the implementation of an open process which connects various value sets and orientations in order to allow for sense-making, collective learning, shared power and a shared approach, which make wicked problems more manageable and provide better enduring results (Schmitt, 2010; Andeweg and van Latesteijn, 2011; Pieters et al., 2012, Peterson, 2013; Bos et al., 2013).

In terms of urban sustainability, for instance, MSE means a move away from an entrepreneurial approach focused almost solely on competition, towards greater emphasis on innovation and external relations, city-to-city cooperation and “city diplomacy” with other political entities (Acuto, 2012). Based on the case of a highly conflictive gas project in Peru involving a variety of belief coalitions, Schmitt (2010) uses the term *open strategizing* to refer to a process that calls for dialogue, sense-making, a more balanced stakeholder participation, and governance mechanisms that help stakeholders to successfully navigate through wicked issues. As with MSE, the main goal of open strategizing is to create the conditions that enable multi-stakeholder consultation and interactions, and encourage governance arrangements which are different from a purely instrumental managerial logic that has been proved ineffective for coping with wicked

sustainability problems. Thus, the engagement of value-divergent stakeholders contributes to stakeholder democracy and democratic processes —such as far-reaching stakeholder consultation—that lead to a more participatory environment, shared responsibility and commitment (Schmitt, 2010). Similarly, in the agriculture sector, Van Latesteijn and Rabbinge (2012) define *sustainable diversification* as the cooperation with a variety of stakeholders —including former adversaries— to develop new markets, products, and designs leading to innovative agribusiness ideas (e.g., energy production, day-care and recreation). In the case of agribusiness more specifically, Peterson explains that MSE is needed in the context of wicked problems for two reasons: (1) because non-business stakeholders can and do veto or enable business actions, and (2) because non-business stakeholders can and do make essential contributions to the new knowledge and innovation needed in the system. When MSE succeeds, the result is innovation where system and process outcomes have been achieved, diverse values are connected, and new knowledge has been created (Peterson, 2013).

Peterson (2013) also presents an important distinction between multi-stakeholder consultation (MSC) and multi-stakeholder engagement (MSE), which are clearly related but substantively different concepts. On the one hand, MSC refers to a hybrid form of transaction coordination that lies in the middle of the continuum between open market transactions and vertical integration. This is, multiple stakeholders together define and manage the nature of exchange in regard to sustainability objectives rather than rely on open market transactions. MSC is defined by the presence of multiple stakeholders, such as businesses, government, societal advocacy groups and knowledge institutions, each having its own motivations and incentives (e.g., power and rule making, advocacy and societal influence, knowledge creation and dissemination). On the other hand, MSE is the process needed to achieve MSC objectives, namely, the management of the exchange of transaction coordination to deliver sustainability by a multi-stakeholder coalition in ways other than an open market. In other words, “MSC is the means of implementing MSE” (Peterson, 2013: 13).

*Success factors:*

Given that there are no project, partnership or multi-sector initiative able to deliver the full spectrum of desirable results to tame a wicked problem, the success of MSE is highly

dependent on the support the process receives from stakeholders who are naturally difficult to involve (Peterson, 2013). For a broad stakeholder consultation to lead to an engagement process, it has to provide a negotiation framework and conditions as for the interested stakeholders at local, national and international levels balance their interests and co-develop solutions (Bos et al., 2013). Such process has to develop an understanding of the stakeholders' responsibilities, secure the interest of local actors, generate clear environmental guidelines and policies on how to manage local natural resources, and develop measures against environmental impacts (Schmitt, 2010). The key here is to invest in managing interactions and articulating relationships between partners at the global and national level, rather than choosing one initiative as the best or the benchmark to address a wicked problem that may acquire as many interpretations as stakeholders involved (Hospes et al., 2012).

A vital task, in this sense, is issue framing (i.e., the way an issue is co-constructed) which has a considerable impact both on the stakeholders around it and their perceptions of the meaning of the proposed solutions. Schmitt (2010) identifies two main sub-strategies for issue framing: listening and learning, and empowerment. The first refers to a resource and time-intensive process of "gaining informational richness" that could generate new ideas and new ways of approaching the problem. The second strategy suggested, empowerment, is a "multi-dimensional social process" that helps people to build capacities and engage in self-defined actions. More locally focused community capacity development, for instance, can generate democratic governance in ways that work with global corporations will never accomplish. This positive aspect of MSE has been noted by Hamilton (2013) in the case of wicked problems affecting sustainability in the mainstream food system. Similarly, Peterson (2013) has demonstrated that the presence of the multiple stakeholders is not in and of itself enough; the fact that they engage throughout the project practicing a wide array of innovation practices (along with process monitoring and reflection to keep co-created innovation at the heart of the project work) is the more critical source of influence on the performance of a solution involving a variety of stakeholders since its inception.

The credibility of involved coalitions of stakeholders is seen as another critical effectiveness factor, a "passage point" (Schmitt, 2010), through which the

aforementioned two strategies needs to be validated. In this sense, credibility is both an “asset to be nurtured” and an “indicator” related to if, and to what extent, a stakeholder is perceived to have the knowledge and the ability to fulfill its claims and if it can be trusted or not. Finally, the development of leadership capabilities are a success factor for MSE, which enables implicated stakeholders to understand a wicked situation from multiple perspectives, to act effectively and achieve commitments that transcend organizational agendas (Hamilton, 2013). Empowered leaders, who associate with others in dealing with their environments while sharing responsibility, are needed to cope with informational richness and structure a process that permits broad stakeholder participation, self-governance and self-reliance (Schmitt, 2010).

*Challenges:*

Implementing multi-stakeholder engagements in practice poses several difficulties for all involved as they start with conflicting values, a strong tendency to veto each other’s actions, and deficient sets of existing knowledge, that further complicate the creation of a diverse stakeholder environment (Schmitt, 2010; Peterson, 2013). Formalizing interactions among stakeholders is complex and can have counterproductive effects if, for instance, the engagement process is under-organized and implicated parties have different levels of expertise (Schmitt, 2010). In the field of sustainable green energy, Cuppen (2012) has demonstrated that the influence of jargon may lead to situations in which some people fully understand what is being discussed and others not at all, which is usually the case when different scientific disciplines interact. Effective MSE can be also jeopardized if some actors (e.g., the public sector) fail to generate the degree of innovative and positive development that others (e.g. the private sector) are creating and/or requiring (Hamilton, 2013).

In terms of the existing knowledge about problems and solutions, Peterson (2013) indicates that it is deficient for at least the following two reasons. First, lack of trust, difference in values and perceptions, and fear of strategic behaviour make the existing knowledge of one stakeholder suspect to other stakeholders. In this sense, Cuppen (2012) indicates that what is a fact to one person may be a value to another person and, as a consequence, conflicts can arise through contradictory values and knowledge claims. Second, according to Peterson (2013), existing knowledge is deficient because it is

exactly the knowledge that led to the existing system tradeoffs that have brought the stakeholders to conflict in the first place. Existing knowledge, therefore, cannot be expected to solve or resolve differences among stakeholders.

Finally, as with other suggested solutions synthesized in this chapter, it has to be noted that there is a bias in the literature towards conceiving MSE as better or even ideal forms of governance (Hospes et al., 2012). Still much additional research and practice are needed to prove the validity and usefulness of effective MSE in different contexts (Peterson, 2013).

## **Discussion**

The synthesis developed in this section presents an initial effort to integrate empirical studies on wicked sustainability problems in different contexts and using a variety of data collection tools. Two lines of discussion emerge from the empirical literature reviewed in this chapter: (i) a theoretical framework on wicked sustainability problems and (ii) five propositions to improve the chances of success for wicked problem-solving approaches.

### **Theoretical framework: the wickedness of sustainability problems**

Based on the thematic qualitative data analysis using NVivo 10, five central themes were identified as critical to the understanding and conceptualization of the wickedness of sustainability problems in the public sector. The five themes are integrated into a framework made of four wickedness dimensions: Stakeholders divergence, Co-existing uncertainties, Institutional complexity, and Environmental dynamism (see Table 4.10). Each dimension has its main sources of wickedness and challenges the problem-solving processes within the public sector in different ways. These sources and their implications may overlap, but for the sake of clarity they are discussed separately.

Table 4.10 Wickedness Framework

Wickedness Dimensions	Sources of Wickedness	Implications for problem solving process
Stakeholder divergence	• Values	Under-participation/engagement
	• Epistemologies	
	• Interests	
	• Images of sustainability	
Institutional complexity	○ Vertical Governance	Dispersion of responsibility
	○ Horizontal Governance	
Co-existing uncertainties	• Ecological	Unpredictability (outcomes)
	• Political (strategies, alliances)	
	• Social (interactions)	
	• Scientific	
Environmental dynamism	○ Ecological (biophysical parameters)	Instability (solutions)
	○ Economic (constraints/resources)	
	○ Social (actors and demands)	
	○ Political (policy goals)	

Source: own

**Stakeholder divergence** refers to the fact that implicated coalitions of stakeholders frame the problem at hand based on competing belief systems (values and epistemologies, group interests and images of sustainability) creating unclear, disputed definitions of a wicked sustainability problem. As explained by Norton (2005: 133), wicked problems are “expressions of competing values and goals.” Hence, any problem definition implies that some values are being under-produced and/or some stakeholders’ interests and viewpoints are being under-represented. The lack of consensus on the essence of the wicked problem underpin escalating level of conflict among stakeholders and limits the capacity of implicated coalitions of stakeholders for concerted and join action (Head, 2010). The underlying argumentation is that the more irreconcilable the belief coalitions are, the more difficult it is to engage other value-divergent stakeholders in the wicked problem-solving process.

The images of sustainability defended and promoted by different coalitions of stakeholders contribute to this lack of consensus on what the problem is and what sustainability actually means in a specific context. Andeweg and van Latesteijn (2011), for instance, indicate that the way in which a “dream” or a “nightmare” is communicated with the use of images and metaphors to represent sustainability goals, has a very strong

impact in the outcome of problem-solving strategies. If nightmare images are dominant, then there is a good chance that the innovation process needed to deal with wicked problems will not happen. On the other hand, if the positive dream of sustainability is strongly visualized, then the use of that positive image can play a crucial role in engaging other coalitions in the process. Similarly, van Latesteijn and Rabbinge (2012) argue that viewing the debates on sustainability and sustainable development as discourses organized around images helps to understand the underlying values of stakeholders and decision makers involved, allowing a more effective framing of the sustainability challenges and progress monitoring. Anthony (2012: 814) stresses that competing images of sustainability are surrounded by “incompleteness, misinformation, values pluralism, competing normative outlooks, manipulative discourses, contradiction, risk, and uncertainty.” As a consequence, such contradictory images further impede value-divergent stakeholders to bridge ethical and epistemological issues along policy-making, and build common research agendas and action plans.

**Institutional complexity** indicates the entanglement of vertical and horizontal governance systems where responsibility is dissected and dispersed among a variety of governmental and non-governmental organizations. Sustainability problems are usually framed within a web of administrative, statutory and legal requirements, which challenges the clear identification of problem structures and their root causes, and the attribution of outcomes to specific policy interventions (Williams, 2006). Many governments —municipal governments, regional authorities, special districts, provincial government, national government— tend to silo their various responsibilities into bodies that are disconnected from each other, and from the broader community, even when they have jurisdiction (sometimes sole, sometimes shared) over different facets of community life (Gollagher and Hartz-Karp, 2013). This dispersion of responsibility among governmental organizations at national and local levels tends to inhibit the integration of perspectives necessary for decisions, policies and programs supporting sustainability.

**Co-existing uncertainties** is used here to identify limitations of current knowledges on the initial conditions, consequences and interaction of ecological, political and social variables. Given the simultaneous presence of different types of uncertainties surrounding

a wicked sustainability problem, it is impossible to predict the consequences of any intervention aimed at resolving the problem (Scherrer and Doohan, 2014).

The problem of uncertainty then goes beyond what Norton (2005: 101) calls “a general label for all the failures of our scientific models” as it extends to other aspects of living in society. Given that divergent belief coalitions receive and comprehend scientific information differently, management and planning approaches to wicked problems aimed at generating only more and better research are not enough to narrow the gap between science and policy outcomes (Sandström, 2010). Scientific means of measurement and quantification alone not only severely limits government's ability to address complex policy problems (Raadschelders, 2011), but also make evaluation and evidence-based practice extremely challenging within such contexts (Williams, 2006). Considering the conflicting values in play, any plan that achieves sustainability over the long term must necessarily not only to get the facts—the science—right, since many will not believe in scientific findings even if it is technically correct (Weber et al., 2011). As Norton (2005: 92) clearly reminds us, “our scientific models must be understood as embedded in a larger process of social discourse and political institutions.”

**Environmental dynamism** refers to constant twists and a high-speed of change in market conditions, political alliances, implicated actors and ecological variables, that make sustainable solutions to come and go (and sometimes come back again) at a rapid face. According to Frame (2008), the dynamic dimension of a wicked issue may determine the extent to which the problem and the solutions change or remain stable: the more dynamic the wicked problem is, the more unstable the implemented solutions will be. Given the open-ended, inter-temporal effects of wicked sustainability problems, the solutions will be acceptable only for a time, “until changing environmental conditions or other changes in the society demand reopening the issues” (Norton, 2005, p. 137).

The dynamic aspect of a wicked problem integrates the aforementioned Theme #5 (wicked solutions) as constant exogenous and endogenous changes put under stress planning and management systems built on assumptions of certainty, predictability and control of planned outcomes. Traditional planning and problem solving approaches rest on certainties and knowledge of initial conditions to identify and quantify thresholds for crucial variables, monitor lists of (generic) indicators and make probabilistic predictions

(Segrave et al., 2012). As those authors demonstrate, however, this command-and-control approach is continually challenged by nonlinear, dynamic transitions in natural systems that make it inapt to deal with sustainability issues because of changes in how problems are perceived by value-divergent stakeholders. Consistent with Norton's (2005) view of a solution to a wicked problem as a "temporary stable point" –i.e., directed at goals in one temporal frame–, this wickedness dimension of sustainability implies that today's solution will lead to a new problem formulation and new forms of competing claims and interests while attempting to develop sustainable solutions.

### **Propositions for wicked problem-solving**

The answer to the second review question highlights the importance of developing comprehensive, holistic multi-disciplinary responses to wicked problems. The idea of a systemic resolution to achieve a more sustainable development, such as system innovation, indicates that all the implicated actors are needed to come up with new modes of production and new institutional and organizational arrangements (Bouma et al., 2011). Using Gollagher and Hartz-Karp's (2013: 2346-7) words: "Sustainability requires that all stakeholders accept responsibility for devising and implementing a systemic response; and all must be accountable to the others for performing the tasks that fall within its sphere of responsibility." Hence the need for new governance mechanisms – such as networks and partnerships– in which inclusive, deliberative, collaborative processes can be embedded, and new trans-disciplinary knowledge can be co-created. However, as the proposed framework suggests, the wickedness factors of a sustainability problem pose the following challenges to think of and implement joint actions: stakeholders' under-engagement/participation, dispersion of responsibility, unpredictability of outcomes, and instability of solutions. What follows are a series of propositions that, based on the empirical literature reviewed in this chapter, may help the reviewed solutions to sustainability problems to reduce their wicked effects and overcome fragmented government action.

*Proposition 1: Stakeholders diversity can help achieve system innovation if the variety of perspectives is managed and/or reduced.*

Without true innovation managing a wicked problem has little hope of success; but the changes to create and implement significant system innovations are maximized only when the diversity among implicated stakeholders is increased (Peterson, 2013). When one or more of the stakeholder types are not present, those left outside the process may end up having negative influence on the project performance. Having a robust set of stakeholders in the coalitions is thus critical from the beginning as they have substantial influence on the initiating conditions of a sustainable project and its performance. Gollagher and Hartz-Karp (2013: 2346) sustain that “anything less than full participation by all who are connected in intricate webs of interactions in linked systems, both natural and social, will reduce the prospects for success.” By enriching the policy process with different types of knowledge, expertise and values, stakeholder diversity may enhance the quality of knowledge for policy decisions on wicked issues and lead to new, robust understanding of the problem and its potential solutions (Cuppen, 2012).

A diverse set of implicated stakeholders thus contributes to the generation of variety of perspectives (i.e., “having ideas to develop courses of action and ideas of solution,” according to Rittel, 1972: 395) and determines the way an issue is collaboratively constructed or framed. However, as already acknowledged by Rittel (1972: 395), to generate variety is not enough to resolve wicked problems: “[it] is the easiest thing in the world; even a computer may be capable of helping here.” The inclusion of more variety into the process induces more divergent thinking, consideration of multiple perspectives (i.e., *stakeholders divergence*) and higher proportions of unshared information (i.e., *co-existing uncertainties*). What it is needed to reduce such variety of ideas and solutions is the construction of evaluation filters (Rittel 1972) in order to exert judgment whether one should try to enlarge the available set of potential solutions and determine which of the solutions should be pursued and implemented (Rittel and Webber, 1973). The main challenge in planning for sustainability is then how to reduce the variety of perspectives (i.e., the integrated whole of beliefs, values, presumptions and worldviews the people use to get to grips with a particular problem) without undermining the much needed stakeholder participation and engagement along the problem-solving/policymaking process. In order to do so, the stakeholder engagement process has to guarantee learning (Cuppen, 2012), be sensitive and open to this diversity, and supportive of different forms

of working together especially if a large number of involved groups are geographically dispersed (Schmitt, 2010).

*Proposition 2: In order to overcome stakeholders' divergence, 'solutions' to wicked problems have to focus on integrating contradictory interpretations of a problem and working toward reconciliation and synthesis (rather than trying to 'solve' the problem).*

According to the reviewed literature, major differences between stakeholders implicated in sustainability problems are expected to be normatively overcome by continuous capacity building (Herrick, 2012), system thinking (Woolthius et al., 2013), participatory decision-making and evaluation processes (Gray and Gill, 2009), ecologically rational strategies (Paquet, 2013), and holistic inter- and intra-generational knowledge production and dissemination (Frame, 2008), to name just a few.

Image management, for instance, is a process aimed at the development of new paradigms and views on sustainable innovation processes (e.g., dream versus nightmare) by bridging differences among conflicting notions of a wicked problem and engaging more stakeholders along the innovation process incorporating their ideas and knowledge at appropriate times (Andeweg and van Latesteijn, 2011; Bouma et al., 2011). What is essential to successful image management, and probably for any wicked problem-solving approach, is to postpone the urge to come up with a "solution" and focus on what constitutes the common challenge for relevant stakeholders and how such challenge is related to their different underlying values (Van Latesteijn and Rabbinge, 2012). Considering that worldviews and values are obviously integral to the concept of sustainability, choosing one initiative as the best or the benchmark or imposing generic classifications may indeed have little practical use (Segrave et al., 2012).

It may sound as a paradox but the aim of a wicked-problem solution should not be to *solve the problem*, but to facilitate the way the problem is framed and allow room for new (re)solutions of the problem's components to surface (Scherrer and Doohan, 2014). As indicated by Woolthius et al. (2013), the challenge in this regard is not only in finding the "good solution" to a wicked sustainability problem but also in creating the conditions in which a good solution can be realized involving the local context in its broadest sense (people, nature, infrastructure, culture, belief systems, etc.).

*Proposition 3: Networks and partnerships can help reduce dispersion of responsibility due to institutional complexity if a multi-stakeholder engagement process is adopted.*

Network-based governance and partnerships that do not fit traditional professional dominance, new public management or market-led paradigms may be a useful policy response that embraces more dispersed authority and action, and supports new forms of cooperation to deal with the institutional complexity of a wicked problem (Cunningham et al., 2012; Everingham, 2012; Gollagher and Hartz-Karp, 2013). But for collaborative governance and partnerships to be effective means for organizing to share scarce resources and achieve collective goals, they need to allow for various forms and degrees of engagement of a diversity of stakeholders, rather than just motivating their participation or collaboration. In traditional stakeholder participation in group debate and decision making, existing knowledge is exchanged and best practices are shared; however, engagement is actually about having stakeholders moving beyond conflict to co-create new knowledge, connect and enhance values, and collectively learn their way to new practices (Peterson, 2013; Bos et al., 2013).

The engagement of multiple stakeholders has to be seen not as an outcome or a product/a solution itself but as the yeast or the catalyst that brings other solutions together. According to the wicked problem at hand, multi-stakeholder engagement may take different denominations and forms; however, they all seem to agree on that a collaborative, deliberative involvement with stakeholders facilitates the discovery of common ground and consensus, creates ownership in joint decisions, and increases trust with positive benefits in the sustainable use and management of natural resources (Weber et al., 2011; Pieters et al., 2012). Stakeholder engagement allows the integration of various value sets and orientations, and creates the conditions for developing a participatory environment, shared responsibility, collective learning and commitment. Such process encourages governance arrangements –e.g., networks– that are different from a purely instrumental managerial logic and a traditional approach to research and knowledge creation (Schmitt, 2010; Andeweg and van Latesteijn, 2011; Pieters et al., 2012, Peterson, 2013; Bos et al., 2013). In terms of improving the chances of engagement, attentional resources need to be invested in managing interactions and articulating relationships between different initiators of partnerships at the global and

national level in a way that is sensitive and open to the diversity of stakeholders and different forms of working together (Hospes et al., 2012; Schmitt, 2010).

*Proposition 4: Policy integration, rather than only coherence and coordination, can help reduce dispersion of responsibility due to the institutional complexity of wicked problems.*

There is a consensus in the reviewed literature on the need of a holistic perspective to successfully avoid the existing fragmentation of responses to a sustainability problem among different policies, agencies, ministries, jurisdictions and levels of government. What is known in the wicked problem literature as a *post-normal policy approach*, for instance, indicates the need of integrating different management responses and governance mechanisms by adopting a whole-of-government perspective, creating boundary organizations, and adopting democratic and collaborative decision-making processes that overcome epistemological boundaries during the policy development process (Williams, 2006; Everingham, 2012; Gollagher and Hartz-Karp, 2013; Hospes et al., 2012; Ozerol et al., 2012; Holman, 2013; see also APSC, 2007; Lorenzoni, Jones and Turnpenny, 2007; Kastenhofer, 2011).

It has to be noted though that, no matter how recurrently *coordination* and *policy coherence* appear in the literature as solutions to wicked problems, only *policy integration* can effectively address fragmented government actions. As explained by Cejudo and Michel (2015), although such concepts are sometimes used interchangeably, integration differs from coordination and coherence not only conceptually but also in practice. Firstly, coordination is a traditional response focused on the decision making process (instruments, mechanisms, responsibilities) and its implementation. Its goal is to reduce policy redundancy, knowledge gaps and contradictions by getting implicated stakeholders to agree upon a common goal and providing the structures and procedures to exchange information and knowledge.

The coordination perspective is thus based on a very strong assumption: despite the differences among stakeholders, consensus decision making and the agreement over a common goal is eventually possible. In the case of wicked sustainability problems, however, Cuppen (2012) has demonstrated that such assumption is not only unreal but also undesirable. The author argued that the interaction and deliberation with other actors

(i.e., “productive conflicts”), rather than consensus building, allow a more open exploration and evaluation of competing ideas and knowledge claims in order to achieve new ideas, insights and options for problem solving (Cuppen, 2012). Similarly, Frame (2008) highlights that successful solutions to wicked problems need to make conflicts among stakeholders come to the fore and manage them, rather than trying to eliminate conflict and lead to resolution through consensus.

Policy coherence, secondly, needs coordination but refers to the complementarity among policies’ objectives, instruments and/or target populations so they not only do not overlap, duplicate or leave vacuums (e.g., unattended populations). Coherent policy frameworks imply that government responses have the ability to achieve together a larger goal based on a shared set of ideas and objectives (May, 2005 in Cejudo and Michel, 2015). It has to be noted, however, that even when coordination works perfectly and coherence among policies can be achieved, fragmented government action will still remain and, even in the best-case scenario, wicked problems will be only partially solved. In other words, coordination and coherence are needed to come up with joint actions, but are by themselves insufficient to address wicked socio-ecological issues.

Finally, the authors propose that policy integration is more than coordinated organizations and coherent programs and/or the sum of both, it is actually a process – rather than a stage or an outcome of policymaking procedures– where decisions are taken in order to define and implement a new integrated policy to achieve a greater, new common goal. In their own words:

“[Integration] means creating a new policy in which its individual components (policies and organizations) work under a new logic, by subordinating their objectives to a new overall goal, and making their decisions based on the needs and priorities of the set of policies and organizations being integrated. This also means that policy integration is not subordinating one policy to another (asking, for example, urban policy to align itself to the priorities of environmental policy), but subordinating a set of policies to a new, overall logic that would determine decisions such as targeting, budgeting, etc.” (Cejudo and Michel, 2015: 11; emphasis in the original).

Policy integration is therefore a decisional logic that has to be applied at every level of management and in every stage of the policy process, both by top officials and policy administrators.

*Proposition 5: Adaptive management can help reduce coexisting uncertainties when it promotes social learning.*

Adaptive management is a promising approach to enhance the adaptability of the policy subsystem to the extent that it is focused on handling, rather than reducing, uncertainties by promoting learning among coalitions of stakeholders with different notions of the problem (Sandström, 2010). As said above, social learning –i.e., a circular and cross-boundary process– is considered a prerequisite for adaptive policy making and effective policy integration, which facilitates systemic practice across and within diverse social groups (Allan, 2012). From an adaptive management approach, long-term survival can be indeed considered a specialized form of social learning, in other words, “learning to adapt practices and actions to the opportunities and constraints stored in local ecological systems” (Norton, 2005: 124).

Such collective learning allows stakeholders on various levels and settings (i.e., public sector, academia, civil society, etc.) to integrate new scientific knowledge with local ecological knowledge, and collectively develop new knowledge by making use of the diversity of perspectives and understandings at hand (Sandström, 2010; Segrave et al., 2012). In this sense, Weber et al. (2011) argue that any strategy that achieves sustainability over the long term necessarily needs to promote learning processes to reinforce beliefs within coalitions and among coalitions with similar analytical approaches. Peterson (2013), however, reminds us that learning and reflection appear not to be natural in certain contexts unless it is explicitly managed and stakeholders are able to resolve conflicting values to take action.

The most transformative form of learning required to deal with wicked sustainability problems is usually known in the public sector management as “triple-loop” (Romme and van Witteloostuijn, 1999). This involves fundamental changes in values, norms, and worldview as a whole, as well as developing new processes or methodologies for reframing social issues; in other words, learning to see things in totally new ways, which

is critical for policy integration as described above. Participatory processes that facilitate multiple-loop learning provide a deeper understanding of problems and challenges in the field of sustainable development, and the key foundations for resource governance at multiple scales (Segrave et al., 2012; Ozerol et al., 2012). Such transformational learning process might involve three key phases: (1) the recognition and critical evaluation of one's own position in relation to that of other stakeholders; (2) performative action in a continual process of change that facilitates a shift in one's assumptions and beliefs, and (3) a dynamic state of "co-experience", a hybrid space in which tolerance and respect facilitate the co-existence of multiple worldviews on an equal basis (Scherrer and Doohan, 2014).

## **Conclusions**

The systematic review presented in this chapter shows that over the last ten years there has been an increasing interest in the wicked problem theory proposed by Rittel and Webber (1973) to represent a variety of public policy problems in different regions of the world. However, academic attention on wicked problems is scattered across a variety of disciplines, research lines and policy areas, making most of the available research on wicked sustainability problems to be siloed and marginalized from mainstream public administration sources. This finding seems to confirm that combining separate vertical research efforts of different disciplines on wicked problems is still quite difficult to achieve.

As an effort to contribute to the accumulation of knowledge in this field of research, this chapter proposes a conceptual framework that synthesizes 32 empirical studies on sustainability issues identified as wicked problems. The studies were undertaken by researchers from different disciplines, using a variety of research methodologies, and addressing issues in a variety of policy areas. The framework is made of four dimensions: stakeholders' divergence, institutional complexity, co-existing uncertainties, dynamism. Each dimension has its main sources of wickedness and implications for addressing socio-ecological problems, respectively: under-engagement/participation, dispersion of responsibility, unpredictability of policy outcomes, and instability of solutions. Five propositions were suggested to improve the chances of success for systemic, adaptive and collaborative responses to a wicked sustainability problem.

Compared to other more recent models and additions to the original theory of wicked problem revised in Chapter 2, the framework presented here provides a more complete understanding of wicked sustainability problems, its distinctive characteristics and their implications for decision making and problem-solving processes in the public sector. The frameworks of Head (2010) and Head and Alford (2008), for instance, are broadly conceptual and theoretical. Contrary to my framework, theirs are not based on empirical evidence that depicts the wickedness of the relation between social and biological systems in a world facing climate change and ecological degradation, which challenges the achievement of sustainable development. Second, both Head (2010) and Head and Alford (2008) studies theorize on the role of divergence, uncertainty and complexity, but underscore the dynamic dimension of a wicked problem, which in the case of sustainability issues appears as a critical, if not the most, problematic aspect. Third, Robert's (2000) classification of problems and strategies is based on a single case study on the relief and recovery efforts in Afghanistan, illustrating the challenges of pursuing a collaborative strategy to cope with wicked problems in crisis countries and developing regions of the world. Robert's focus on conflict and power to represent a wicked problem however useful for her case study, it seems to be limited to comprehend the wickedness of a socio-ecological issue, where dynamic changes of, and the lack of knowledge about, socio-political variables and biophysical parameters are highly relevant. Further theoretical and practical implications of this first study are discussed in the Chapter 9.

## **Chapter 5. Wicked Problem Framing and Perception of Solutions (Method)**

### **Introduction**

Wicked sustainability problems can be seen as “expressions of competing values and goals” (Norton, 2005: 133) where a variety of stakeholders, each with a particular notion of the issue at hand, try to influence and determine its definition and the nature of its resolution. The lack of consensus on how a wicked problem is framed by actors with competing values and interests is indeed considered the most salient aspect of such public policy issues and the core of Rittel and Webber’s (1973) theory.

As explained in Chapter 4, in the field of sustainability the framing process of a problem (i.e., the way an issue is co-constructed) is the most crucial phase in planning adaptation to contextual change, and it has a considerable impact on how people perceive the effectiveness of proposed solutions (Schmitt, 2010; Andeweg and van Latesteijn, 2011; Segrave et al., 2012). In the case of wicked problems, the act of framing is continuously surrounded by co-existing uncertainties, risk and lack of knowledge about initial conditions and future consequences (Adams, 2010; Weber et al., 2011; Segrave et al., 2012). Stakeholders’ divergent perceptions of uncertainties and risks are used to define wicked problems in different ways, leading to conflict around the urgency of a particular issue and the best way to address it (Weber et al., 2011; Anthony, 2012; Scherrer and Doohan, 2014). Understanding the multiplicity of frames and interpretations at play is critical to explaining the lack of a collective perception of a wicked sustainability problem, the stakeholders’ divergent analytical approaches to problem solving and, eventually, their limited capacity for concerted and join action. In this study I analyze how arbitrary changes in the presentation of a wicked issue (i.e., problem framing) affect policy decisions, and what the implications are for a theory of government attention on wicked problems from an individual level of analysis.

Although most theories in the social sciences commonly assume that people confronting important decisions approximate rational decision making processes, empirical research indicates that often they do not and, on the contrary, systematically deviate from normative theories of choice (e.g., Tversky and, Kahneman, 1981; Quattrone and Tversky, 1988; Shafir, 1993; Mercer, 2005; Fatas et al., 2007; Lee and

Park, 2011). As explained in Chapter 2, the original theory of wicked problems (Rittel, 1972; Rittel and Webber, 1973) was in fact developed as a response to the limits of normative, rational models of decision making to predict or explain behaviours in uncertain and complex situations. The purpose of this study is to explore if a different decision theory could provide a better explanation of how people tend to reason and make decisions on wicked problems. More specifically, this study is focused on the application of prospect theory (PT) in scenarios involving policy decisions in the field of socio-ecological sustainability.

PT was originally developed by Amos Tversky and Daniel Kahneman as an alternative to expected utility theory (EUT) in order to explain the effects of framing in a wide variety of risk-based decision contexts (Kahneman and Tversky, 1979; Tversky and Kahneman, 1981). Rational choice theories are based on expected-utility models that assume the way information is framed should not influence our judgment or assessment of that information and, therefore, it's possible to predict certain choices people will make in the light of the postulates of rational behaviour (see von Neumann and Morgenstern, 1947; Savage, 1954; Ellsberg, 1961). However, in a series of experimental studies, Tversky and Kahneman found that people systematically violate the postulates of EUT, and that the way people interpret the outcomes of choices (i.e., prospects) influences how much risk they are willing to take. According to PT, (i) the manipulation of frames determines whether an outcome is evaluated as a *gain* or a *loss*, and (ii) most people tend to support risk-averse decisions in the domain of gains (i.e., under positive framing conditions) and risk-seeking in the domain of losses (i.e., under negative framing conditions). The fact that people would reverse their risk preferences depending on alternative descriptions of the problem is usually called *framing effect*. It plays a substantial role in decision-making processes and is at the center of the debate regarding whether the rational theory of choice provides an accurate description of behaviour (Levin et al., 1998; Druckman, 2001; LeBoeuf and Shafir, 2003). The specific goal of this study is to investigate the explanatory power of prospect theory and the presence of framing effects in the case of wicked sustainability problems through an experimental research design aimed at addressing several hypotheses and research questions presented in the next section.

The reason explaining the decision of applying PT to the case of wicked problems is that it is the most influential behavioural theory of choice in the social sciences that provides an adequate description of how people actually make choices under conditions of risk and uncertainty (Levin et al., 1998; Mercer, 2005; Kuehnhanss et al., 2015). As other authors have demonstrated in very complex public issues with wide and deep socioeconomic implications –such as health, safety and the environment–, the decisions of the general public and policy makers on such issues often do not follow the predictions of expected utility theory but the tendencies suggested by prospect theory (e.g., Fatas et al., 2007; Lee and Park, 2011; Linde and Vis, 2015). We usually believe that people's choices reflect their underlying values and preferences (Ellsberg 1961); however, various studies on decision making indicate that such assumption do not always hold and people often arrive at a decision problem not with well-established and clearly ranked preferences (Tversky and Kahneman, 1981; Shafir, 1993; Ledgerwood and Boydston, 2014). As Shafir (1993) has demonstrated in his framing experiments, preferences are constructed –not only revealed– while making decisions, and are also sensitive to various aspects of a decision problem giving rise to inconsistencies among decision makers. In other words, preferences are not priori to a choice but we actually figure them out during a choice; therefore, preferences are neither stable nor hierarchical as EUT assumes (Mercer, 2005).

PT can be considered one of the best alternatives we have yet to explain or predict such deviations and inconsistencies in uncertain and complex decision scenarios as the ones that characterize wicked problems. While rational theories can help decision makers understand how rational actors should behave if everyone adheres to normative decision theory, a behavioural decision making theory –such as PT– helps explain how people tend to reason in such situations and may also help in designing policy toward others or in shaping public opinion and policy options (Mercer, 2005; Arceneux, 2012). In order to achieve consensus on public issues and/or generate majority support for one policy alternative instead of another, for example, messages can be framed effectively according to the assumptions proposed by PT, which will allow to know what people are likely to do or think in risky, uncertain and complex situations, rather than what they should do (Druckman, 2001; Lee and Park, 2011). Knowing what decision makers are supposed to

do from a normative decision theory is not often helpful in dealing with wicked problems because it can lead to major mistakes or bad advice when there are questions of reliability and relevance of information and/or conflicting opinions and evidence around certain decision problems (Ellsberg, 1961; Mercer, 2005).

To my knowledge this is the first study that uses an experimental research design to test the validity of prospect theory and the presence of framing effects in the case of wicked problems. PT was originally developed to analyze choices about monetary outcomes and lives that could be saved or lost as a consequence of a policy decision in situations where the probabilities of outcomes were explicitly stated (Kahneman and Tversky, 1979; Tversky and Kahneman, 1981). More recently, PT has been extended to other topics, such as economic policy (Kuehnhanss et al., 2015; Linde and Vis, 2015) and international relations in crisis situations (see Mercer 2005, for reviews), as well as to social and environmental contexts (Wilson et al., 2008). Manipulation of decision frames has been found to affect also choices in a variety of other domains, for example, medicine, voting, gambling, public goods allocation, and persuasion (see LeBoeuf and Shafir, 2003).

In their seminal work, Tversky and Kahneman (1981: 457) argued that although their results are “by no means universal, framing effects are large and systematic,” and that the main properties of PT’s value function for money should apply to other attributes as well (Kahneman and Tversky, 1979). More recent work, however, has shown that framing effects sometimes vary by topic: for instance, people tend to be more risk-seeking with problems involving life-death decisions than with problems involving public property, personal money, or investments (Wang, 1996; Druckman and McDermott, 2008). This study aims to test whether, in the case of wicked sustainability problems, decision makers are subject to framing effects and what the implications are for policy making in general, and for a process of government attention in particular. The study is organized as follows: in this chapter I describe the hypotheses and research questions, the research design and data analysis procedure, while the next chapter presents the main results, discussion and limitations of this experimental study.

## Hypotheses and Research Questions

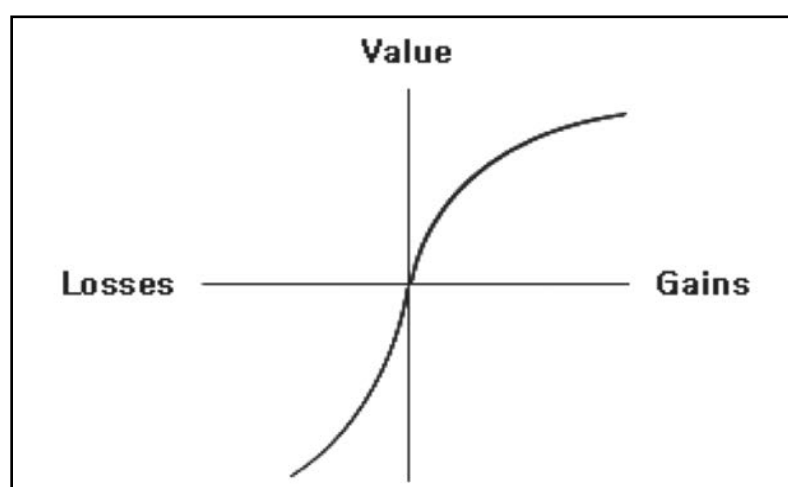
Rational choice theories are the preferred tool-kit and dominating paradigm in political science (Frey and Eichenberger, 1989; Kuehnhanss et al., 2015). They are built on expected-utility models that assume that decision makers' preferences obey the axioms of invariance and coherence to maximize the utility function that underlies the (economic) notion of rationality (Quattrone and Tversky, 1988). *Invariance* means that the preference order among options (i.e., prospects) should not depend on how they are described, as long as the content is not changed. *Coherence* requires an option to be always preferred over all other options, as long as it is better in one state of nature and at least as good in all other states. Based on these EUT axioms, the way in which options are framed in a given problem should not have any impact on the options selected if their outcomes are equivalent: rational decision makers will always prefer the option that offers the highest expected utility regardless of how the information about options and outcomes is provided. Tversky and Kahneman (1981: 454) challenge these two axioms and propose prospect theory, "an approximate, incomplete, and simplified description of the evaluation of risky prospects." In order to investigate whether prospect theory can be applied to explain judgments and decisions in significant risk contexts involving wicked problems in the field of sustainability, I propose a series of hypotheses and research questions to test PT's basic principles, effects and biases described below.

### Attitudes towards risk and behavioural biases

Prospect theory is an alternative theory of choice that explains numerous deviations from the predictions of rational choice theories found in several psychology experiments. It suggests that people have a different value function and decision-weighting function than those proposed by EUT and that, based on such functions, there is a particular susceptibility to the way in which the information is framed (positively or negatively) that influences how people approach a risk and that biases their decisions. On one hand, Tversky and Kahneman (1981) explain that, contrary to the expected utility function which has a concave form, the value function in prospect theory has an S-shaped form where decision makers put greater weight on the value of losses than on the value of gains (Figure 5.1). On the other hand, the decision weight function in PT takes a non-linear form which means that an event with low probability is overweighted, whereas

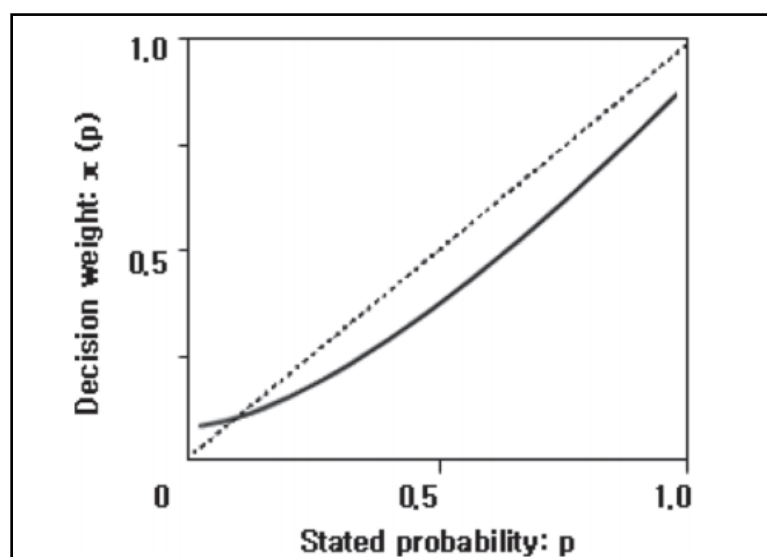
those with a moderate or high probability are underweighted (Figure 5.1). This implies that people tend to give more value to the utility of a possible outcome than to its probability of occurrence as long as probabilities are not too small (Levy, 2003). If probabilities are very low, people's behaviour can be unpredictable given their limited ability to evaluate extreme probabilities. This makes highly unlikely events to be either ignored or overweighted (e.g., some people buy insurance against rare natural disasters but others do not) (Kahneman and Tversky, 1979).

**Figure 5.1. Prospect theory's value function**



Source: Tversky and Kahneman (1981)

**Figure 5.2. Prospect theory's decision-weighting function**



Source: Tversky and Kahneman (1981)

*Loss aversion and shifts in reference point (framing of outcomes).* PT generates different attitudes towards risks than those prescribed by EUT, giving rise to behavioural anomalies or biases that cannot be explained by rational choice models. Based on an important property of PT's S-shaped value function called loss aversion, people tend to overvalue losses relative to comparable gains. This cognitive bias (Arceneux, 2012) implies that the displeasure associated with losing a sum of money is generally greater than the pleasure associated with winning the same amount of money (Quattrone and Tversky, 1988). Such attitudes depend on whether an outcome is perceived as *gain* or *loss* relative to a neutral reference point, rather than to final states of wealth and welfare. The reference point usually corresponds to the decision maker's current asset position but the location of the reference point, and the consequent perception of outcomes as gains or losses, can be affected by the formulation of prospects and by the expectations of the decision maker (Kahneman and Tversky, 1979). This reference dependence (Levy, 2003) runs contrary to the axioms of EUT and creates asymmetries in the way in which people evaluate outcomes above and below the reference point. In presence of loss aversion, shifts in the reference point induced by positive or negative framing of a problem will have predictable effects on people's risk preference: people are risk-averse in the domain of gains and risk-seeking in the domain of losses (Quattrone and Tversky, 1988).

**Hypothesis 1:** when a decision involving a wicked sustainability problem is framed so as to focus on the positive outcomes (i.e., gain domain), decision makers tend to favour the more certain of two options that have equivalent expected values (i.e. the decision makers are risk averse). Alternatively, when the framing of solutions to address a wicked problem focuses on negative outcomes (i.e., loss domain), they tend to favour the less certain option (i.e., the decision makers are risk takers).

*Sensitivity to outcome description and ratio-difference principle.* PT defies EUT's invariance principle that requires that the order of preferences among options should not depend on how the outcomes and probabilities are described. The corollary of the invariance principle is that alternative formulations of the same problem should yield the same choice. According to PT's ratio-difference principle, however, people are more sensitive to outcomes described negatively (e.g., 10% unemployment rate) than positively (90% employment rate), and the impact of any fixed positive difference between two options increases with their ratio. This means, for instance, that choices about economic

policies proposing a change in the unemployment rate of 10% to 5% –ratio of 2– will have a greater impact on the public than policies that propose a change from an employment rate of 90% to 95% –ratio close to 1– despite the fact that both changes would produce the same outcome (Quattrone and Tversky, 1988). Similarly, if the ratio-difference principle holds, the difference in value between a gain (loss) of \$100 and a gain (loss) of \$200 appears to be greater than the difference between a gain (loss) of \$1,100 and a gain (loss) of \$1,200 (Kahneman and Tversky, 1979).

**Hypothesis 2:** the preference order among alternatives to address a wicked problem depends on how the outcomes and probabilities are described and, if the ratio-difference principle holds, the marginal value of both gains and losses will decrease with their magnitude.

*Certainty effect (framing of contingencies).* In the case of PT, the certainty effect holds which implies that reducing the probability of an outcome by a constant factor has a greater impact when the outcome is initially certain than when it is merely possible (Tversky and Kahneman, 1981; Quattrone and Tversky, 1988). This is, people tend to overweigh outcomes that are considered certain relative to outcomes that are merely probable: in the positive domain, the certainty effect contributes to a risk-averse preference for a sure gain over a larger gain that is merely probable, whereas in the negative domain the overweighting of certainty leads to a risk-seeking preference for a loss that is merely probable over a smaller loss that is certain (Kahneman and Tversky, 1979). PT attributes the certainty effect to the properties of the decision weight function; this is, in the negative domain, the undesirability of losses (as well as the desirability of gains) that are certain increases relative to the losses (and gains) that are merely probable (Kahneman and Tversky, 1979; Tversky and Kahneman, 1981).

**Hypothesis 3:** when proposed solutions to address a wicked sustainability problem have uncertain outcomes, the certainty effect holds. Thus, a sure gain is favoured over a probabilistic gain and a probabilistic loss is preferred to a definite loss, favouring risk aversion in the domain of gains and risk seeking in the domain of losses.

*Status quo bias.* A consequence of loss aversion is the endowment effect, which means that people tend to value something they possess more than comparable things that they do not have. Accordingly, a person would be willing to sell an object in her possession at a particular price, though she would never think of buying it at the same price, only at a

lower price. A direct implication of both loss aversion and the endowment effect is a preference for the status quo over alternatives with the same expected value. This anomaly is incompatible with EUT that considers the preference between two options should not depend on whether one or the other is designated as the status quo (Mercer, 2005). For instance, Coase theorem that is based on EUT postulates states that in the absence of transaction costs people will make mutually advantageous exchanges (i.e., Pareto efficient outcomes) independently of the initial allocation of property rights (Coase, 1960). The status quo bias, on the contrary, implies that if a person frames a choice problem around the existing status quo, she will treat the costs of moving away from the status quo as a loss and the benefits of moving away from the status quo as a gain, overweighting the losses relative to the gains and demonstrating a tendency towards remaining at the status quo (Levy, 2003).

**Hypothesis 4:** in decision making scenarios involving wicked problems the status quo tends to be preferred over alternatives with the same expected value.

Based on these principles, PT accepts *reversals of preference* as a consequence of how options are described when the problem frames contain the same information about values and probabilities associated with outcomes. As said above, such framing effects violate the principles of invariance and coherence proposed by EUT as the pillar of rational behaviour. Preference reversals, it is worth noting, do not imply that people affected by framing effects are necessarily “irrational” but that judgment and choice –like perception and memory– are prone to error and distortion (Tversky and Kahneman, 1981; Quattrone and Tversky, 1988). Prospect theory proposes that such behavioural anomalies can be caused by the non-linearity of values and decisions weights and variations in the formulation of choices, more specifically by changes in the framing of acts, contingencies and/or outcomes of decision problems (see Tversky and Kahneman, 1981). The first type refers to the framing of a complex decision in terms of only its combined final outcomes or in terms of its components. In this case, it is the object of choice which decision makers have to choose that is framed (e.g., a small sure gain versus a higher uncertain gain), not only the consequences involved here. The framing of contingencies is a way to frame the possible value of an outcome in terms of certainty ( $p=1$  or  $p=0$ ) or uncertainty ( $0 < p < 1$ ), where the components of the decision problem are not independent of one

another (i.e., progression onto the second stage of a problem is contingent on the outcome of the first stage) (Levin et al., 1998; Lee and Park, 2011). The framing of outcomes involves variation in the psychological reference point by the labelling of outcomes, for example, the amount of lives saved or lost as in the Asian disease experiment described below (Tversky and Kahneman, 1981).

### **Support to solutions to wicked problems based on contingencies and outcome framing**

Framing can shape preferences and generate more or less support for one policy alternative instead of another depending on the perceived strength (i.e., persuasiveness) of political arguments and what impact they have on judgment (Druckman, 2001; Chong and Druckman, 2007; Arceneux, 2012; Ledgerwood and Boydston, 2014). Chong and Druckman (2007), for instance, have demonstrated that the better the quality of frames in terms of logic of the argument, source credibility and other features of the source and the message, the stronger public opinion moves in the direction advocated by the frame. Arceneux (2012) supports this argument providing evidence that the contextual information surrounding the frame (either internal or external to the message) can successfully activate biased information processing, making some framed arguments more persuasive than others. As shown in Chapter 4, arriving at consensus around the substance of, and the solution to, a wicked issue is highly difficult but also necessary to implement concerted and joint actions across public and non-public decision makers.

Lee and Park (2011) indicate that message framing has a significant effect on the formation of public opinion and support to policies. Based on previous findings of research on PT, the authors developed two hypotheses on public support to the Korea-US free trade agreement and tested the main effect of both outcome and contingency framing on achieving public consensus on that trade policy. Hypotheses H5 (a) and (b) below adapt the Lee and Park (2011) hypotheses to the case of a hypothetical wicked problem. An additional hypothesis, H5 (c), was added to check for the interaction effect of both types of framing on reaching support around policies and solutions to wicked problems.

**Hypothesis 5(a):** In terms of the framing of policy outcomes, framing a message as a loss is more effective than framing it as a gain in achieving support to solutions to wicked sustainability problems.

**Hypothesis 5(b):** In terms of the framing of contingencies, framing a message as certain is more effective than framing it as an uncertain in achieving support to solutions to wicked sustainability problems.

**Hypothesis 5(c):** The effect of uncertain contingency framing on achieving agreements about solutions to wicked sustainability problems depends on the framing of policy outcomes as negative. Conversely, the effect of certain contingency framing on agreements on solutions to wicked problems depends on framing policy outcomes as positive.

#### Attribute framing (accepting vs. rejecting)

Levin et al. (1998) indicate that prospect theory can only explain framing effects in situations that involve risk perception. The authors argue that in addition to risky choice framing explained by PT, there are two other forms of framing in decision scenarios without the presence of risk, namely, attribute framing and goal framing. The three types of framing respectively differ one from the other in terms of what is framed (options with different risk levels; objects/events characteristics; consequences of a behaviour), what is affected by framing effects (risk preference; item evaluation; impact of persuasion), and how such effect is measured (comparison of choices; attractiveness of a prospect; behaviour adoption). Each type of framing, in turn, influences information processing and attention processes differently, and has diverse perceptual and cognitive implications (Levin et al., 1998). Goal framing is considered the most complicated type of framing in that more than one aspect of the message may be manipulated (e.g., linguistic and contextual variations), making it difficult to extract what influence the frame has on judgment and information processing. For this reason, the presence of this type of framing effect will not be tested in this study. Attribute framing, on the contrary, is seen as the “simplest case of framing” as only one attribute within any given context is the subject of the framing manipulation, and it does not involve a manipulation of riskiness (Levin et al., 1998).

Shafir (1993) illustrates attribute framing effects comparing responses to *choosing* the more desirable of two options versus responses *rejecting* the more undesirable option. In his study, participants were presented with two alternatives, an *enriched option* (with more extreme positive and negative features) and an *impoverished option* (with fewer extreme positive and negative features). Shafir found that when people were asked to choose the more desirable option, a majority of participants selected the enriched option

and the same happened when other participants were asked to reject the less desirable option of the two: they selected also the enriched option. These findings suggest that when people are asked to do the positive task of selecting between two options they focus their attention on a comparison of the positive features and choose the option with the more positive features. Conversely, when asked to do the negative task of rejecting one of two options they focus on comparing the negative features of the two and reject the option with more negative features. Thus, in the first case they select the enriched option and in the second they reject it. The relative importance of options' strengths and weaknesses thus varies with the nature of the task (Shafir, Simonson and Tversky, 1993). According to Levin et al. (1998: 167), "this attentional effect is realized as a shift in the weights applied to positive and negative attributes with a change in task frame." In order to test the presence of attribute framing effects as described by Shafir (1993) in the case of wicked problems, I propose the following hypothesis:

**Hypothesis 6:** when a proposed solution to a wicked sustainability problem has more extreme positive and negative attributes (i.e. enriched option) than the other (i.e., impoverished option) then preference strengths may be influenced depending on whether the decision is framed in terms of which option to accept, or which option to reject.

#### Susceptibility to framing (moderating factor)

Tversky and Kahneman (1981) argue that framing effects occur in decision making scenarios involving the loss of human lives (such as their Asian Disease Experiment [ADE]; see below) and in choices about money, and such effects are not restricted to hypothetical questions or eliminated by monetary incentives. However, the results of recent studies on framing effects are not clear about the validity of Kahneman and Tversky's initial theoretical accounts in other domains outside consumer choice and financial contexts (see Levin et al., 1998; Druckman, 2001; Wilson, 2008; Kuehnhanss et al., 2015). As the evidence presented in the literature points in different directions and it is not possible to make clear predictions about the applicability of prospect theory and framing effects in decision scenarios involving wicked sustainability problems, I pose the following research question:

**Research question (RQ7):** If people are susceptible to framing effects in decisions involving loss of human lives and in consumer and financial contexts, are they also susceptible to framing effects in decisions involving wicked problems in the field of sustainability?

### **Protected values (moderating factor)**

Most normative theories of rational decision making require trade-offs between values, such as protection of the environment versus the creation of jobs. These are called *compensatory values* because a small change in the satisfaction of one value can be compensated by a change in some other value (Baron and Spranca, 1997). If people have compensatory values that can be traded off, then it may be possible to arrive at utilitarian decisions that maximize total utility, i.e., total value satisfaction. However, some people may have *protected values* which are absolute, not negotiable values that resist trade-offs for other values (Baron and Spranca, 1997; Levin et al., 1998; Wilson, 2008). Protected values violate the EUT principle of coherence that assumes that, if we are indifferent between two options A and B, and we get additional reasons for choosing A (or B), we should favour A (or B). In contrast, people with protected values regarding A, for instance, will not swing their preference for B regardless of additional arguments in favour of such option (Baron and Spranca, 1997).

Research on the topic has demonstrated that people with protected values are quantity insensitive and domain insensitive. The former means that for people with protected values the quantity of consequences related to an option is irrelevant and what is important is the act, not its result (e.g., destroying one species through a single act is as bad as destroying a hundred species through the same act; Baron and Spranca, 1997). The latter implicates that people with protected values are insensitive to the type of consequence (i.e., gain or loss) of an act but are sensitive to the fact that a critically important value (e.g., protection of endangered species) is changing (Wilson, 2008). Tanner and Medin (2004) have proved in the case of hypothetical environmental scenarios that people with strong protected values are immune to framing, while participants with few protected values show robust framing effects. They indeed suggest that research on framing may benefit from taking account of protected values as a moderating factor, as they can be associated with the absence of framing effects. In order to verify if protected values can help explain the presence of framing effects in wicked decision scenarios, I ask the following question:

**Research question (RQ8):** Do people holding protected values regarding the environment respond differently to framing manipulations in decision making scenarios involving wicked sustainability problems?

## **Research Design**

### **Participants (sample)**

Between March and April 2017, a total of 89 participants were recruited at the University of Victoria, Canada, mostly graduate and undergraduate students enrolled in diverse education programs, from Fine Arts and Humanities to Engineering and Science. The participants (60 women, 29 men) ranged in age from 18 to 40+ years old. The sample is by no means representative of the broader population but it is quite diverse. The participants were offered a CAD \$15 coffee gift card as a form of compensation for their time to complete the study (approximately 45 minutes).

### **Materials and procedure**

Every participant received a booklet divided into five parts, containing a variety of decision making scenarios and a questionnaire about environmental attitudes and values. Each of these instruments is described below.

#### **Framing problems (hypothetical sustainability scenarios)**

In order to investigate Hypothesis 1 (H1) to Hypothesis 5 (H5), I developed six original framing problems inspired by the work of Tversky and Kahneman (1981), Quattrone and Tversky (1988), and Lee and Park (2011) that reported systematic violations of expected utility theory in support of prospect theory. Hypothesis 6 (H6) is addressed by modifying a decision problem designed by Shafir (1993) to verify the presence of framing effects in situations that do not involve risk perception. The seven decision making scenarios have been adapted to depict wicked problems in the field of sustainability.

The literature reviewed in Chapter 4 presents different ways of conceptualizing sustainability as a wicked problem but it highlights the following common basic characteristics: the interaction of ecological and human systems; tensions between long-term ecological goals and short-term economic and political gains; and problem-solving processes for sustainable development that may be themselves wicked problems. To recreate a wicked decision situation, I have developed hypothetical decision making scenarios that capture the clash between timescales, the contradictions and trade-offs between ecological versus economic goals, and/or the fact that certain solutions to sustainability issues can create another (wicked) problems. Each decision problem is

followed by a prediction of experimental results based on the aforementioned description of prospect theory. If the predictions are confirmed, it would be possible to argue in favour of the validity of PT and the presence of framing effects when people try to make decisions involving wicked sustainability problems.

To test H1, I adapted the famous Asian Disease Experiment (ADE) originally developed by Tversky and Kahneman (1981) that shows that when a decision is framed so as to focus on the positive outcomes decision makers tend to favour the more certain of two options that have equivalent expected values (i.e. the decision makers are risk-averse). Alternatively, when the framing focuses on negative outcomes, people tend to favour the less certain option (i.e., the decision makers are risk-takers). In the original ADE, participants receive a hypothetical decision making scenario that states that a rare disease is threatening 600 people and they need to choose one of two available programs to fight the disease. Program A provides a certain outcome, whereas Program B carries risk by offering two possible outcomes and their respective probabilities. Participants receive the programs either framed negatively (i.e., lives lost) or positively (i.e., lives saved), but both versions of the problem are mathematically equivalent.

Tversky and Kahneman demonstrated that discrete choices between a risky and a riskless option of equal expected value depend on whether the options are described in positive terms or in negative terms. The authors found that this subtle difference in the presentation of alternative solutions caused a *choice reversal* phenomenon even though both available choices are equivalent. On one hand, the majority of subjects who were given the positively framed version of the problem [a sure saving of one-third the lives (i.e., 200 people) versus a one-third chance of saving all the lives and a two-thirds chance of saving no lives] selected the option with the certain outcome (Program A). On the other hand, the majority of subjects who were given the negatively framed version [a sure loss of two-thirds the lives (i.e., 400 people) versus a one-third chance of losing no lives and a two-thirds chance of losing all the lives] chose the risky option (Program B). The reader is referred to Tversky and Kahneman (1981) for a more detailed description of the ADE.

There are many studies that have used replications and adaptations of the ADE to test Tversky and Kahneman's (1981) choice reversal prediction (e.g., Druckman, 2001;

Areceneux, 2012; Khuenhanss, 2015; see Levin et al. 1998 for a review). I have adapted ADE to be applied in a wicked problem in the field of urban sustainability following the basic form of the risky choice framing (see Levin et al., 1998). I focused on a hypothetical urban development issue (i.e., housing and living conditions) because it is considered a wicked sustainability problem (e.g., Adams, 2011), involves tradeoffs between social values, and has received some attention in prior work on framing effects (e.g., Chong and Druckman, 2007). This is also a sensitive problem for people in the community where the research was conducted, receiving periodic media coverage (e.g., Vancouver Sun, 11/22/2016 and 6/10/2017). Based on the original ADE, the manipulation of frames involves the presentation of a decision scenario with two possible choice options: one is a riskless, certain prospect and the other is a two-outcome, all-or-none risky alternative whose probabilities are expressed numerically. To be consistent with the original problem, I framed the decision scenario following this manipulation logic and used the same probability structure presented by Tversky and Kahneman (1981). All the subjects received the same neutral cover story; then, some were randomly selected to receive the positive frame of the problem where the outcomes of both prospects are described in terms of gains (i.e., families returning to an improved housing area), while others were given the negative frame in which the outcomes are presented in terms of losses (i.e., families forced to find alternative housing). Both versions present options with equivalent value. Problems 1.1 (positive condition) and 1.2 (negative condition) are as follows:

**Problem 1.1 (gain domain – positive condition)**

The municipality of Magnolia is interested in renovating one of the most deprived areas of the city to tackle the severe social problems of the marginalized groups in the area and increase urban value. As part of the planned development, the municipality has decided to renovate social rental apartments in a dilapidated government-owned building to improve housing and living conditions. During renovation, the 300 current tenant families will be temporarily reallocated and could move back after the renewal is finished. The current rent of each apartment will be increased after renovation. Very poor families could be reluctant to move back into their upgraded apartments as they will be obligated to pay higher rent and utility payments. Two different funding models are being considered, Model A and Model B. Assume that the consequences of the different models are as follows:

- If Model A is adopted, 100 of the original families will be able to move back to an improved housing area.

- If Model B is adopted, there is a 1/3 probability that all 300 of the original families will be able to move back to an improved housing area and a 2/3 probability that none of the original families will be able to.

Imagine you were faced with the decision of adopting Model A or B. Which would you select?

**Problem 1.2 (loss domain – negative condition)**

[Same cover story]

- If Model A is adopted, 200 of the original families will be forced to find alternative housing.

- If Model B is adopted, there is a 1/3 probability that none of the 300 original families will be forced to find alternative housing and a 2/3 probability that all of the original families will be forced to find alternative housing.

Imagine you were faced with the decision of adopting Model A or B. Which would you select?

**Prediction:** If the original ADE results hold for the problem above, more participants will choose Model A in frame 1.1, and Model B in frame 1.2.

In order to verify the application of PT's ratio-difference principle and predictions about sensitivity to outcome description (Hypothesis 2), I have adapted two examples developed by Quattrone and Tversky (1988) that provide evidence in favour of the ratio-difference effect. Their examples no. 9 and 10 present two versions of a given choice problem, which are logically equivalent. Participants are faced with the decision of adopting one of two economic policies that while they lead to higher rates of employment also have an adverse effect on inflation. Example 9 presents the consequences of the two available policies as rate of work force unemployed (10% versus 5%), whereas example 10 presents them as rate of work force employed (90% versus 95%). In the first example the ratio of a change from one program to the other yields a factor of 2 (i.e., 10%/5%), while in the second example the factor is 0.95 (i.e., 90%/95%). Quattrone and Tversky (1988) found a significant preference reversal comparing both examples, with people showing higher sensitivity to choices framed as unemployment rates rather than as employment rates. The authors conclude that the greater the ratio-difference the greater is the impact of framing on perception.

To test H2, I adapted both examples to a hypothetical wicked case that presents a trade-off between economic goals (i.e., generation of jobs and industrial development) and ecological goals (i.e., protection of forest areas). The positive frame describes outcomes

as percentages of *protected forest*, whereas the negative frame defines outcomes in terms of *deforested areas*. As with problems 1.1 and 1.2 above, for the sake of consistency with the original problems, I presented to the participants the same numbers, ratios and percentages used in the original examples:

**Problem 2.1 (loss domain – negative condition)**

The province will expand irrigation schemes in a protected area to generate billions of CAD in benefits and thousands of new jobs in the food production industry. In order to expand irrigation schemes some areas have to be cleared of forest. A decision must be made between two projects currently being considered:

- If project A is adopted 10% of the area will be deforested, while 17,000 new jobs will be created.

- If project B is adopted 5% of the area will be deforested, while 12,000 new jobs will be created.

Imagine you were faced with the decision of adopting project A or project B. Which would you select?

**Problem 2.2 (gain domain – positive condition)**

[Same cover story]

- If project A is adopted 90% of the forest in the area will be protected, while 17,000 new jobs will be created.

- If project B is adopted 95% of the forest in the area will be protected, while 12,000 new jobs will be created.

Imagine you were faced with the decision of adopting project A or project B. Which would you select?

**Prediction:** If respondents show more sensitivity to the outcomes described negatively (i.e., ‘deforested’ areas) rather than positively (i.e., ‘protected’ areas), and the ratio-difference principle holds, a majority of participants will choose project B than project A in frame 2.1; while a majority of participants will choose project A rather than project B in frame 2.2.

To test for the presence of the certainty effect (Hypothesis 3), I have developed a decision problem inspired by Quattrone and Tversky’s (1988) examples no. 13 and 14 that challenge the assumption of well-defined preferences. Normative choice theories assume that the utilities of outcomes are weighted by their probabilities: according to the substitution axiom of EUT, if option X is preferred to option Y, then a probability mixture that yields X with a probability  $p$  and 0 otherwise should be preferred to a mixture that yields Y with probability  $p$  and 0 otherwise. Quattrone and Tversky describe a series of choice problems in which people’s preferences violate this axiom. The authors presented the participants with a pair of binary choice problems under risk in which the

second problem is derived from the first one by multiplying the probability of a gain with a common factor. People violate EUT if this common ratio modification of the probability of a gain induces a change in choice. As explained by Khaneman and Tversky (1979), this modification produces a greater reduction in desirability when it alters the character of the prospect from a sure gain to a probable one, than when both the original and the reduced prospects are uncertain. In each example, Quattrone and Tversky developed a hypothetical decision scenario where participants need to make a choice between two policies that yield savings in energy expenditures according to specific probabilities. In this case, there are no positive and negative conditions and all the participants reply to both examples.

As with the previous problems above, I used the same monetary values and probability structure presented in the original problem. The scenarios were adapted to depict a hypothetical policy decision involving the construction of an oil pipeline that can have negative socio-ecological impacts but also generate resources to develop a transition plan to renewable energy. The examples are as follows:

### **Problem 3**

The federal government is interested in building a new pipeline in Province Alpha to get oil and gas to new markets. The proposed expansion will increase taxes collected at federal, provincial and municipal level and generate revenues to fund a transition plan to shift towards greater use of cleaner and safer sources of energy. The Ministry of Environment and Natural Resources is considering two projects to expand the pipeline in Province Alpha:

- If project A is adopted is virtually certain that over the next four years it will generate tax revenues for \$20M that will be reallocated to the energy transition plan.

- If project B is adopted, there is an 80% chance that over the next four years it will generate \$30M in tax revenues to be reallocated to the transition plan, and 20% chance that the project will produce no tax revenues to fund the transition plan.

Imagine that you were faced with the decision of adopting project A or B. Which would you select?

### **Problem 4**

The federal government is also interested in building a new pipeline in Province Gamma to get oil and gas to new markets. The proposed expansion will also increase taxes collected at federal, provincial and municipal level and generate revenues to fund a transition plan to shift towards greater use of cleaner and safer sources of energy. The Ministry of Environment and Natural Resources is considering two projects to expand the pipeline in Province Gamma:

- If project C is adopted there is a 25% chance that it will generate tax revenues for \$20M that will be reallocated to the energy transition plan, and 75% that no tax revenues will be generated to fund the transition plan.

- If project D is adopted, there is a 20% chance that over the next four years it will generate \$30M in tax revenues to be reallocated to the transition plan, and 80% chance that the project will produce no tax revenues to fund the transition plan.

Imagine that you were faced with the decision of adopting project C or D. Which would you select?

**Prediction:** If the certainty effect holds, reducing the probability of a gain (i.e., generating tax revenues to develop an energy transition plan) from 1 to 0.25 has a greater effect than the reduction from 0.8 to 0.2. In problem 3, project A (\$20M) has no variance while project B (\$30M, 0.8) has large variance; therefore, the former option could be chosen despite its lower expected value. In problem 4, when the prospects are reduced, the difference in variance between project C (\$20M; 0.25) and project D (\$30M; 0.2) may be insufficient to overcome the difference in expected value. Thus, it is expected that more respondents will select project A in problem 3 and project D in problem 4.

In order to check for the presence of the status quo bias (Hypothesis 4), I have used as a model the examples no. 5 and 6 developed by Quattrone and Tversky (1988). In those examples, participants have to make a choice between the policies of two presidential candidates that will affect the rate of unemployment and inflation. The examples offer the same choice and differ only in the location of the status quo, which coincides with one candidate's policy in example 5 and with the other candidate's policy in example 6. The authors found that the majority of choice in both examples favoured the status quo policy. This finding is incompatible with standard utility theory because the status quo is not perceived as neutral but it is higher evaluated than the policy with the same expected value.

I adapted these examples to be applied to wicked problems in the field of sustainability by presenting the participants with two policies that have environmental and economic consequences. Policy A proposes an unemployment rate of 15% and carbon dioxide emissions of 60 megatonnes, whereas Policy B proposes an unemployment rate of 20% and carbon dioxide emissions of 50 megatonnes. Some participants were randomly selected to receive problem 5.1 where Policy B represents the status quo, while other participants were given problem 5.2 where Policy A is the status quo.

**Problem 5.1**

Assume you were a policymaker faced with the decision of adopting one of two policies that involve a tradeoff between economic and environmental goals:

- Policy B will keep greenhouse gas emissions and unemployment at their current levels. Carbon dioxide emissions are currently at 50 megatonnes per annum while the unemployment rate is at 20%.

- Policy A proposes to decrease the unemployment rate to 15% but at the cost of increasing carbon dioxide emissions to 60 megatonnes.

Which policy would you vote for?

**Problem 5.2**

Assume you were a policymaker faced with the decision of adopting one of two policies that involve a tradeoff between economic and environmental goals:

- Policy A will keep greenhouse gas emissions and unemployment at their current levels. Carbon dioxide emissions are currently at 60 megatonnes per annum while the unemployment rate is at 15%.

- Policy B proposes to decrease greenhouse gas emissions to 50 megatonnes per annum but at the cost of increasing unemployment to 20%.

Which policy would you vote for?

**Prediction:** If the status quo bias holds, participants will prefer the status quo over alternatives with the same expected value. In frame 5.1, policy B supports the status quo and should be preferred by a majority of participants. In frame 5.2, policy A represents the status quo. The expectation is that there should be stronger support for policy B in problem 5.1 and for policy A in problem 5.2.

The next problem has been adapted to test Hypotheses 5(a) to 5(c) based on the study of Lee and Park (2011) that analyzes in a single decision problem how the framing of outcomes and contingencies influence the possibility of arriving at agreements on policies. I developed a 2 (framing of outcome: gain/loss) x 2 (framing of contingency: certainty/uncertainty) experimental design, forming four experimental groups. Each participant received a balanced message showcasing the advantages and disadvantages of approving a major pipeline expansion, and one of the four experimental messages depending on the group where they were randomly assigned. Participants had to decide whether or not they agree with the expansion of the pipeline in two provinces of Canada. The balanced and experimental messages are shown below. The outcomes presented in messages 6.1 and 6.3 are mathematically equivalent when the contingencies are certain, as well as the outcomes of frames 6.2 and 6.4 under uncertain contingencies.

### **Problem 6**

The federal government of Canada has to make a decision on the approval of a major pipeline expansion from Province A to Province B. Those who support the project argue that the project will help make sure Canada gets full value for its oil, oil producers will earn more revenue for their product, and the federal and local governments will collect more tax revenue from oil that will go towards services that benefit all Canadians. Those who reject the project argue that the new pipeline will have an impact on future greenhouse gas emissions, increase the likelihood of oil spills, affect indigenous rights, and put at risk marine mammal safety. [*Note: all the participants received this balanced message*]

#### **Experimental message 6.1 (contingency: certain – outcome: gain)**

According to a study of an independent expert panel, if the pipeline is approved, the environmental impact of its construction would be the equivalent of putting an additional 2 million cars on the road over the next 5 years. However, according to the same study, if the extra tax revenue the pipeline will generate would be put into accelerating innovation in clean energy technologies, it will have an environmental impact of taking the equivalent of 5 million cars off the road over the next 10 years.

#### **Experimental message 6.2 (contingency: certain – outcome: loss)**

According to a study of an independent expert panel, if the pipeline is not approved, no extra tax revenue would be generated to put into accelerating innovation in clean energy technologies with the equivalent environmental impact of not taking 3 million cars off the road over the next 10 years.

#### **Experimental message 6.3 (contingency: uncertain – outcome: gain)**

According to a study of an independent expert panel, if the pipeline is approved, the environmental impact of its construction would be the equivalent of putting an additional 2 million cars on the road over the next 5 years. However, according to the same study, if the extra tax revenue the pipeline will generate would be put into accelerating innovation in clean energy technologies, it will have an 80% probability of taking the equivalent of 6.25 million cars off the road over the next 10 years.

#### **Experimental message 6.4 (contingency: uncertain – outcome: loss)**

According to a study of independent expert panel, if the pipeline is not approved, no extra tax revenue would be generated to put into accelerating innovation in clean energy technologies and there is an 80% probability that 3,75 million cars will not be taken off the road over the next 10 years.

**Predictions:** Based on the nonlinear characteristics of the value function and decision-weight function of prospect theory, people tend to avoid risks in situations involving gains and prefer certainty-framing alternatives to uncertainty-framing alternatives. Thus, it is expected that a message framed as a loss would be more effective in achieving support for the construction of the pipeline than one framed as a gain (H5a), and that a message framed as a certainty would be more effective in achieving support than one framed as an uncertainty (H5b). If both effects are combined, framing the construction of

the pipeline as an uncertain loss or a certain gain (H5c) would be the most effective way of reaching consensus around its construction.

To test Hypothesis 6 I used Shafir's (1993) accepting/rejecting experiment described above. The decision making scenario was adapted to present the participants two projects for generating electricity that have social, economical and environmental consequences. One option has both positive and stronger negative attributes (i.e., project B, the enriched option) and the other has weaker positive and weaker negative attributes (i.e., project A, the impoverished alternative). Some participants were randomly selected to *recommend* one of these two projects, while other participants were asked to *reject* one of them. The problem is shown below.

### **Problem 7**

Government officials are considering which of two options for generating electrical power to recommend to their superiors for government support. The proposed projects would have equivalent capital and operating costs but the issues are complex, involving many different stakeholder groups, and have potential social, economic, environmental and political consequences. The main consequences are highlighted below, and you must base your decision entirely on these.

Project A	Project B
Modest electrical output	Very high electrical output
Medium lifespan	Long lifespan
Average potential environmental impact	Potential for significant environmental damage in remote areas
Little change to local employment	Sustained increase in local employment
Minor political fallout	Likely strong political gains
Little stakeholder opposition	Major opposition from some stakeholder groups

Based on these, which of the two proposals would you reject? [**Frame 7.1**]

Based on these, which of the two proposals would you recommend? [**Frame 7.2**]

**Prediction:** If the task is which project to recommend then attention tends to be drawn to positive attributes, thereby participants will favour the enriched option (project B). Conversely, if the decision is framed in terms of which option to reject, attention is drawn to negative attributes, thereby disfavoring the enriched option. The expectation is that more participants will choose project B in both frames 7.1 and 7.2, reflecting a preference for project A under frame 7.1 and a preference for project B under frame 7.2.

### Parallel framing problems

To help answer Research Question 7 I tested the participants' susceptibility to framing effects. They received five sets of decision making scenarios involving monetary and life-and-death choices. Each set consists of two parallel decision problems that figure prominently in previous work on framing and/or are representative of problems used in previous research on the topic (see Table 5.1). It is assumed that if participants are susceptible to framing effects they would make inconsistent decisions in each set of parallel problem. For instance, comparing parallel problems (a) and (f) presented in Table 5.1, participants who are not susceptible to framing effects will choose option A in both problems indicating that they are risk-averse and prefer a certain gain of \$400. Alternatively, they will choose option B if they are risk-takers and want to get a chance of getting \$500 if they are lucky or \$300 if they are not. In either case the expected values posed by options A and B in each problem are the same (\$400 versus \$300/\$500); therefore, participants susceptible to framing effects will choose option A (B) in problem 1 and B (A) in problem 6. The same logic applies to the rest of parallel problems. Participants received five parallel problems in part 2 of the study and the other five problems in part 4. Both parts were kept apart from each other (approximately 15/20 minutes apart) by the hypothetical sustainability scenarios described above.

**Table 5.1. Parallel framing problems**

<b>Problem</b>	<b>Parallel</b>	<b>Source</b>
a. Assume yourself richer by \$300 than you are today. You have to choose between (A) a sure gain of \$100 and (B) a 50% chance to gain \$200 and 50% chance to gain nothing	f. Assume yourself richer by \$500 than you are today. You have to choose between (A) a sure loss of \$100 and (B) a 50% chance to lose nothing and 50% chance to lose \$200	Tversky and Kahnemann 1986
b. Imagine that Canada is preparing for the outbreak of an unusual disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimates of the consequences of the programs are as follows: If Program A is adopted, 200 people will be saved. If Program B is adopted, there is a one-third probability that 600	g. Following a submarine attack a warship with a crew of 600 is in flames. Unless the fire can be brought under control, the ship's store of ammunition will explode. The ship's captain has two courses of action open. Plan A is to abandon ship immediately. However, because of stormy weather conditions and extreme distance from any help, if Plan A is adopted, 400 people will die. Plan B is to try to control the fire.	Tversky and Kahnemann 1981

<p>people will be saved and a two-thirds probability that no people will be saved.</p>	<p>If Plan B is adopted, there is a one-third probability of preventing the explosion and nobody will die and a two-thirds probability of failing, and all 600 people will die.</p>																											
<p>c. Imagine that you have decided to see a play and have paid the admission price of \$50 per ticket. As you enter the theatre you discover that you have lost the ticket. The seat was not marked and the ticket cannot be recovered. Would you pay \$50 for another ticket?</p>	<p>h. While at the mall you decide to drop by the bookstore to buy a book advertised on sale for \$20. As you look for the book, you realize that you have lost a \$20 bill. Would you still buy the book?</p>	<p>Tversky and Kahnemann 1981</p>																										
<p>d. A hardware store has been selling snow shovels for \$15, discounted \$5 below the regular price. This morning after a heavy snowfall, the store removes the discount and raises the price to \$20. Please rate this action as Fair Unfair</p>	<p>i. A shortage has developed for a popular model of automobile, and customers must now wait two months for delivery. A dealer has been selling these cars at list price. Now the dealer prices this model at \$200 above list price. Please rate this action as Fair Unfair</p>	<p>Kahneman, Knetsch and Thaler (1986)</p>																										
<p>e. Imagine that you serve on the jury of an only-child sole-custody case following a relatively messy divorce. The facts of the case are complicated by ambiguous economic, social, and emotional considerations, and you decide to base your decision entirely on the following few observations. Which parent would you award sole custody of the child?</p> <table border="0"> <thead> <tr> <th><u>Parent A</u></th> <th><u>Parent B</u></th> </tr> </thead> <tbody> <tr> <td>- average income</td> <td>- above-average income</td> </tr> <tr> <td>- average health</td> <td>- very close relationship with the child</td> </tr> <tr> <td>- average working hours</td> <td>- extremely active social life</td> </tr> <tr> <td>- reasonable rapport with the child</td> <td>- lots of work-related travel</td> </tr> <tr> <td>- relatively</td> <td>- minor health</td> </tr> </tbody> </table>	<u>Parent A</u>	<u>Parent B</u>	- average income	- above-average income	- average health	- very close relationship with the child	- average working hours	- extremely active social life	- reasonable rapport with the child	- lots of work-related travel	- relatively	- minor health	<p>j. Imagine that you are planning a week vacation in a warm spot over spring break. You currently have two options that are reasonably priced, but you can no longer retain your reservation for both. The travel brochure gives only a limited amount of information about the two options. Given the information available, which reservation would you decide to cancel?</p> <table border="0"> <thead> <tr> <th><u>Location X</u></th> <th><u>Location Y</u></th> </tr> </thead> <tbody> <tr> <td>- lots of sunshine</td> <td>- average weather</td> </tr> <tr> <td>- gorgeous beaches and coral reefs</td> <td>- average beaches</td> </tr> <tr> <td>- ultra-modern hotel</td> <td>- medium-quality hotel</td> </tr> <tr> <td>- very cold water</td> <td>- medium-temperature water</td> </tr> <tr> <td>- very strong winds</td> <td>- average nightlife</td> </tr> <tr> <td>- no nightlife</td> <td></td> </tr> </tbody> </table>	<u>Location X</u>	<u>Location Y</u>	- lots of sunshine	- average weather	- gorgeous beaches and coral reefs	- average beaches	- ultra-modern hotel	- medium-quality hotel	- very cold water	- medium-temperature water	- very strong winds	- average nightlife	- no nightlife		<p>Shafir (1993)</p>
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stable social life	problems		
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Source: own

#### Questionnaire on environmental attitudes

In order to answer Research Question 8, I used the questionnaire developed by Milfont and Duckitt (2010) to measure environmental attitudes (EA) as a psychological tendency expressed by evaluating the natural environment with some degree of favour or disfavour. Based on a cumulative and theoretical approach to the measurement of EA, Milfont and Duckitt developed the Environmental Attitudes Inventory (EAI) that consists of 12 specific scales that capture the main environmental facets measured by previous research in terms of preservation and utilization of the natural environment. The authors suggest that EA have both a horizontal and a vertical structure, where the former refers to the first-order factors (i.e., the 12 scales) and the latter refers to the second-order factors (i.e., preservation and utilization). Preservation factors indicate that “priority should be given to preserving nature and the diversity of natural species in its original natural state, and protecting it from human use and alteration” (Milfont and Duckitt, 2010: 81). Such factors are related to symbolic attitudes regarding the environment and predict ecological behaviours. In contrast, Utilization factors represent the general belief that “it is right, appropriate and necessary for nature and all natural phenomena and species to be used and altered for human objectives” (Milfont and Duckitt, 2010: 81). Utilization expresses instrumental attitudes regarding the environment and predicts economic liberalism.

As Milfont and Duckitt (2010) indicate, there are hundreds of EA measures available based on different conceptual and theoretical frameworks, with no accepted gold standard measure in the literature. The authors established the 12 factors through confirmatory factor analyses, in which the EAI scales are shown to be uni-dimensional with high internal consistency, homogeneity and high test-retest reliability, and also to be largely free from social desirability effects. The authors designed three versions of the EAI based on the amount of items tested in each scale. The complete EAI has 10 items per scale (total 120 items), the short-form EAI-S includes 6 items per scale (72 in total), while the brief version EAI-24 measures only two items per scale. Taking into account the considerable amount of time needed to complete both the full EAI and the EAI-S

questionnaires, I use the EAI-24 that yields 14 preservation items and 10 utilization items. Given this study's particular focus on sustainability issues, I added to the questionnaire the sustainability scale also developed by Milfont and Duckitt (2010).

Thus, all the participants received a questionnaire containing 26 items to be answered using a 7-point Likert rating scale (where 1 = Strongly disagree and 7 = Strongly agree). Table 5.2 below presents the 13 environmental attitudes measured in this study. Each scale contains a positively worded and a negatively worded item; the participants received a mix of 13 positive and negative items at the beginning of the study (booklet's part 1) and 13 positive and negative items at the end (part 5). Because the two items of each scale were easier to be identified as literally opposite, parts 1 and 5 of the study were kept apart from each other (approximately 20/30 minutes apart) by the hypothetical sustainability scenarios and the parallel problems presented above. The separation between frames was intended to be long enough so as not to render the recurrence of the problems immediately apparent to all respondents (a similar experimental procedure was used by LeBoeuf and Shafir, 2003). When participants arrived to part 5 they were not allowed to modify the responses provided in part 1.

**Table 5.2. Environmental Attitudes scales**

<i>Scale 01. Enjoyment of nature</i>
1.1. I really like going on trips into the countryside, for example to forests or fields.
1.2. I think spending time in nature is boring.
<i>Scale 02. Support for interventionist conservation policies</i>
2.1. Governments should control the rate at which raw materials are used to ensure that they last as long as possible.
2.2 I am opposed to governments controlling and regulating the way raw materials are used in order to try and make them last longer.
<i>Scale 03. Environmental movement activism</i>
3.1. I would like to join and actively participate in an environmentalist group.
3.2. I would NOT get involved in an environmentalist organization
<i>Scale 04. Conservation motivated by anthropocentric concern</i>
4.1. One of the most important reasons to keep lakes and rivers clean is so that people have a place to enjoy water sports

4.2. We need to keep rivers and lakes clean in order to protect the environment, and NOT as places for people to enjoy water sports
<i>Scale 05. Confidence in science and technology</i>
5.1. Modern science will NOT be able to solve our environmental problems.
5.2. Modern science will solve our environmental problems
<i>Scale 06. Environmental threat</i>
6.1. Humans are severely abusing the environment.
6.2. I do not believe that the environment has been severely abused by humans.
<i>Scale 07. Altering nature</i>
7.1. I'd prefer a garden that is wild and natural to a well groomed and ordered one.
7.2. I'd much prefer a garden that is well groomed and ordered to a wild and natural one.
<i>Scale 08. Personal conservation behaviour</i>
8.1. I am NOT the kind of person who makes efforts to conserve natural resources.
8.2. Whenever possible, I try to save natural resources.
<i>Scale 09. Human dominance over nature</i>
9.1. Human beings were created or evolved to dominate the rest of nature.
9.2. I DO NOT believe humans were created or evolved to dominate the rest of nature.
<i>Scale 10. Human utilization of nature</i>
10.1. Protecting peoples' jobs is more important than protecting the environment
10.2. Protecting the environment is more important than protecting peoples' jobs.
<i>Scale 11. Ecocentric concern</i>
11.1. It makes me sad to see forests cleared for agriculture
11.2. It does NOT make me sad to see natural environments destroyed.
<i>Scale 12. Support for population growth policies</i>
12.1. Families should be encouraged to limit themselves to two children or less.
12.2. A married couple should have as many children as they wish, as long as they can adequately provide for them.
<i>Scale 13. Sustainability</i>
13.1. In the development of our society we must strive to meet the needs of the present without compromising the ability of future generations to meet their own needs
13.2. The idea that we should try to meet the needs of the current generation without undermining the ability of future generations to meet their own needs is wrong

## Data Analysis

### Measuring framing effects

Two approaches can be adopted to evaluate the existence or strength of framing effects in the seven hypothetical scenarios described above. The first approach is called unidirectional effect (or *choice shift*), which entails the comparison of percentage of participants who selected the risk-averse option (or the risk-taking alternative) in the gain domain against the percentage of participants who chose the risk-averse option (or the risk-taking alternative) in the loss domain. The second approach is called bi-directional effect (or *choice reversal*), which assesses the presence of risk-averse choice in the gain domain and the risk-seeking choice in the loss domain. Bi-directional effects involve a reversal of risk-preference, and they are found when a great percentage of respondents (over 50%) opt for the risk-averse alternative under the gain domain and fewer than 50% of respondents opt for the risk-averse alternative under the loss domain. Thus, the difference between a choice shift and a choice reversal is that in the first approach the proportion of risky choices differs across conditions but is not both significantly greater than 50% in the negative condition and significantly less than 50% in the positive condition (Levin et al., 1998). See Wang (1996) for a further description of both approaches.

The first evaluative approach shows differences among preferences when one frame is used instead of another equivalent frame. Unidirectional effects provide insights into the power of framing when frames that push preferences in opposite directions are used (risk-averse versus risk-seeking behaviours) (Druckman, 2001). When unidirectional effects predominate, respondents lean towards either the certain or the risky option in both frames, but in one more so than in the other (i.e., the majority for the preferred option becomes larger) (Kuehnhanss et al., 2015). The second approach reveals if one frame causes a majority of participants to opt for one alternative (e.g., the risk-seeking choice) while the other frame causes the majority opt for the other alternative (e.g., the risk-averse choice). A bidirectional effect implies that participants reverse their preferences depending on the frame presented; thus, it is expected that the majority of participants will choose the riskless option in the gain domain and the risky option in the loss domain.

Both approaches could be used in any given study and each of them provides different insights: the unidirectional approach indicates the relative impact of alternative, equivalent frames of preferences, whereas the bidirectional approach reveals if a majority preference reversal occurred (Druckman, 2001). “Identifying such a majority reversal in preference can be important for those interested in if different frames can generate majority support for one alternative instead of another,” says Druckman (2001: 95). In the original ADE (Tversky and Khaneman, 1981), for instance, the results are significant using either of the two approaches.

In this study, I will check for the presence of both effects in each of the seven hypothetical decision scenarios by comparing percentages of subjects choosing one option or the other across frames. Building on previous work on PT and framing effects, the statistical significance of the results found in problems no. 1, 2, 5 and 6 is verified conducting a Chi-Square test, those of problems no. 3 and 4 are jointly verified through a sign test, while a logistic regression is used in problem no. 7. If the results are significant and point in the predicted direction, then it would be possible to conclude that there is an association between frames (positive/negative, certain/uncertain) and decisions made by the participants. This would confirm that people are affected by the framing of outcomes and contingencies when they attend to, and make decisions around, wicked problems in the field of sustainability.

### **Measuring susceptibility to framing effects**

In order to know if participants are susceptible to framing effects in diverse decision making scenarios, I developed three different framing susceptibility scores for each participant using the results of the parallel problems and the hypothetical sustainability problems. The first score, Susceptibility Score I ( $SS_I$ ), is based on the consistency of decisions made in each of the five sets of parallel problems. As explained above, if a participant makes consistent decisions it is assumed that she is not susceptible to framing, and vice-versa. Consistency requires that a respondent choose the same option in both frames of a problem (e.g., option A (or B) in the parallel problems (i) and (vi) shown in Table 1), while inconsistency implies that one option is chosen in one frame and another option in the other frame (LeBoeuf and Shafir, 2003). When participants make consistent decisions in each pair of problems they receive 0 points, indicating that they are not

affected by framing effects. Conversely, if they make inconsistent decisions in a pair of parallel problems they receive 1 point. Building on the work of LeBoeuf and Shafir (2003), an average personal score was calculated for each participant. The score ranges from 0 (when all of the participant's answers were consistent) to 1 (if all the answers were inconsistent).

LeBoeuf and Shafir (2003) indicate that when participants are presented with two opposite frames (as with the parallel problems) the possibility of inconsistency may become salient, and people might alter their second response so as to maintain consistency, in line with the EUT requirement of invariance. Tversky and Kahneman (1986) point out that people try to adhere to normative principles, such as consistency and coherence, when their applicability is detected, but they often violate such principles when they are not detected. Therefore, being successful at avoiding inconsistent decisions does not necessarily mean to avoid framing effects per se (LeBoeuf and Shafir, 2003). For this reason, I developed a second individual susceptibility score, Score II ( $SS_{II}$ ), based on the results of the sustainability problems no. 1 to 7. Following LeBoeuf and Shafir (2003), each respondent received one frame of each problem (i.e., positive or negative, certain or uncertain) and their responses, which captured the participants' tendency to provide frame-biased responses, were compared against theoretical framing predictions. As with the previous susceptibility score,  $SS_{II}$  ranges from 0 (if none of the participant's answers were consistent with the predicted choices, given the provided frames) to 1 (if all answers were consistent with framing predictions). Following this same logic, I developed a third measure of susceptibility to framing, Susceptibility Score III ( $SS_{III}$ ), analyzing each of the parallel problems separately and comparing the participants' responses against theoretical predictions. In this case,  $SS_{III}$  also ranges from 0 to 1 depending on the consistency of responses against framing predictions proposed in the original studies where the parallel problems were taken from (see Table 5.1 above).

In order to answer RQ7 and check if people susceptible to framing effects in decisions involving non-wicked problems are also affected by framing in decisions involving wicked sustainability problems, a Pearson correlation test is performed to verify the significance of relationships between both susceptibility scores. If the correlation is positive and significant, it would be possible to argue that people are susceptible to

framing effects in both types of decision making scenarios. On the contrary, if there is a significant negative linear correlation between scores, this would indicate that people may be susceptible to framing in one scenario but not necessarily in the other.

Additionally, a T-test for dependent means is used to compare the three susceptibility scores and check if participants' responses are significantly different under wicked and non-wicked decision making scenarios.

### **Measuring protected values**

The presence of protected values regarding the environment was inferred from the participants' responses to the EAI questionnaire based on the following procedure. First, the 13 scales were divided into Preservation and Utilization factors according to Milfont and Duckitt (2010) classification: scales 1, 2, 3, 6, 8, 11 and 12 comprise the Preservation factors, while scales 4, 5, 7, 9 and 10 comprise the Utilization factors. The sustainability scale (#13), not originally included in the EAI-24, was considered as part of the Preservation factors.

Second, for each of the 13 scales an individual Environmental Attitude score was calculated. The EA score is the result of the value given to the positively worded item minus the value given to the negatively worded item in each scale, according to the 7-point Likert scale the participants were asked to use to answer the questionnaire. It is expected that participants with strong environmental attitudes would make consistent decisions, choosing opposite values for each item of the same scale (i.e., if a participant rates a positively worded item with a value of 7, then she will rate the opposite item with a value of 1).

Third, all the Preservation factors were added to calculate a Preservation score for each participant. Similarly, an individual Utilization score was calculated for each subject. Fourth, a total EA score is calculated for each participant as the result of the Preservation score minus Utilization score. The assumption here is that the higher the score, the stronger the participant's environmental attitude in terms of utilization and preservation factors.

To test if participants with protected values are more resistant to framing effects than those with no protected values regarding the environment according to this measure of protected values, a variety of correlation tests are performed.

The results of the analysis described in these sections are presented in the next chapter, as well as their implications for policy making and attention processes in government organizations.

## Chapter 6. Wicked Problem Framing and Perception of Solutions (Findings)

### Introduction

This chapter is organized in ten sections that report the results of the experimental study. Based on the hypotheses presented in the previous chapter, the first six sections discuss the application of prospect theory's principles and the presence of framing effects when people make decisions on wicked sustainability problems. The seventh and eighth sections analyze two moderating factors (i.e., susceptibility to framing and protected values, respectively) that explain why some people are more sensitive than others to framing effects. The last two sections are dedicated to discussion and conclusions.

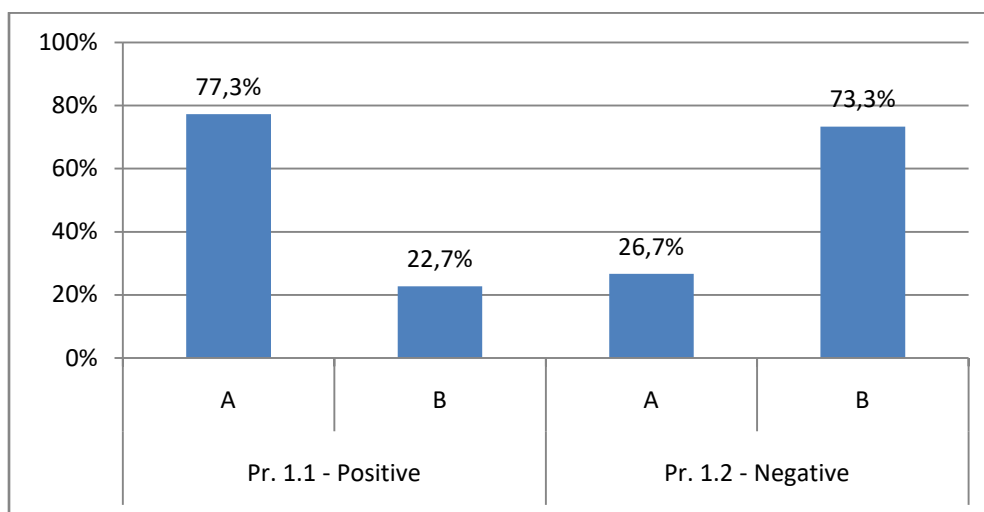
### Loss aversion and shifts in reference point (framing of outcomes)

Problems 1.1 and 1.2 show a tendency towards loss aversion when people make decisions on a wicked problem involving urban sustainability and housing affordability issues. Hypothesis 1 was supported ( $\chi^2(1)=22.85$ ;  $p<0.0001$ ) indicating a choice reversal (bi-directional effect) as predicted by Tversky and Kahneman (1981) in the original ADE. This is, under the positive framing condition a majority of participants (77.3%) preferred to be risk-averse and opted for the more certain option –i.e., Model A–, while only 22.7% chose Model B. Conversely, under the negative framing condition more participants (73.3%) preferred Model B that carries some risk, whereas 26.7% opted for the alternative, certain option. Consistent with previous work on PT, these two problems demonstrate that decision makers will assume more risk to avoid a prospect framed as a loss than they will to obtain the identical outcome framed as a gain (Mercer, 2005). Using the original phrasing, problems 1.1 and 1.2 confirm that for risk-averse participants “losses loom larger than gains” (Kahneman and Tversky, 1979: 279). See Figure 6.1 below.

The results show that a change in the reference point (i.e., *families moving back to an improved housing area versus families forced to find alternative housing*) generates different perceptions of policy outcomes as gains or losses. In this case, there is a clear contradiction in the way participants who received the positive frame evaluated solutions compared to those who received the negative frame of the problem. Support to model A,

that guarantees accommodation only to 100 out of 300 affected families, is 2.9 times higher when its outcomes are framed positively. Conversely, support to model B, which yields a relatively high probability of leaving 300 families without affordable housing solution, is 3.2 times higher in the negative domain than in the positive domain.

**Figure 6.1. Loss aversion and changes in reference point**



Source: own

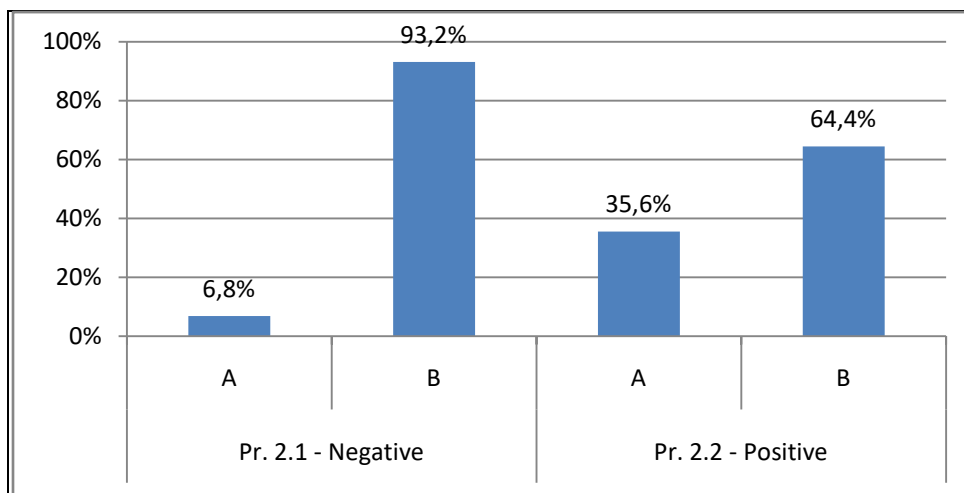
### **Sensitivity to outcome description and the ratio-difference principle**

In line with the previous finding on loss aversion, problems 2.1 and 2.2 confirm a significant choice shift that demonstrates that respondents are more sensitive to policy outcomes described negatively (i.e., deforested areas) rather than positively (i.e., protected areas) even though both problems present equivalent policy options. In this case, there is a unidirectional effect that shows more support –over 5 times higher– for project A when it is framed positively (35.5%) than when it is framed negatively (6.8%). See figure 6.2 below. Problems 2.1 and 2.2 provide evidence in favour of the ratio-difference principle in the case of this wicked ecological sustainability problem, confirming that the marginal value of a loss increases with its magnitude and it has a greater impact on perception.

Under the negative framing condition, the ratio of outcomes between the alternatives is two times higher than under the positive framing condition, and it stands out more focally in problem 2.1 than in problem 2.2. It is worth recalling that in both cases the participants

are presented with conflicting ecological and economic goals that affect job creation equally. However, because of the ratio-difference principle, clearing a forest area to expand the food production industry and increase employment rates is relatively perceived more as an ecological nuisance in problem 2.1 (negative framing) than in 2.2 (positive framing). Hypothesis 2 is thus supported ( $\chi^2(1)=10.94$ ;  $p<0.001$ ).

**Figure 6.2. Outcome description and Ratio-difference principle**



Source: own

### **Certainty effect (framing of contingencies)**

Hypothesis 3 proposes that, if the certainty effect holds in a pair of binary choice problems under risk (problems 3 and 4), in the positive domain a sure gain is favoured over a larger probabilistic gain, while in the negative domain a probabilistic loss is preferred to a smaller sure loss. Thus, according to PT's certainty effect, it is expected that a majority of respondents would select project A in problem 3 and project D in problem 4, favouring risk aversion in the domain of gains and risk seeking in the domain of losses. The results show that while the modal response in problem 3 was in fact project A ( $n=70$ ), the most preferred choice in problem 4 was project C ( $n=51$ ). This finding does not coincide exactly with Quattrone and Tversky (1988) prediction of a shift in modal preferences. However, given that all the participants responded to both problems, it is important to examine also the frequency of the four possible combinations: AC, AD, BC and BD. The results are shown in Table 6.1.

**Table 6.1. Modal responses in binary problems**

Problem 3	Problem 4	
	C	D
A	48% (n=43)	30% (n=27)
B	9% (n=8)	12% (n=11)

As described in Chapter 5, problem 4 is derived from problem 3 by multiplying the probability of a gain (i.e., generating tax revenues to develop a renewable energy plan) with a common ratio of  $\frac{1}{4}$ . Based on Quattrone and Tversky (1988), the combinations AC and BD are in line with

EUT, whereas AD is consistent to prospect theory's certainty effect, and BC is incompatible with both PT and EUT.

Table 6.1 shows that of 35 participants whose choice pairs violate EUT predictions, 77% (n=27) deviate according to the certainty effect. This result is significant as the one-tailed sign test reveals ( $p=0.0001$ ), providing support for Hypothesis 3 and confirming that when the probability of a policy outcome is reduced it has a greater effect on perception than when it was merely possible. Thus, 30% of the sample was affected by the certainty effect and, accordingly, considered that the difference in variance among projects C and D was insufficient to overcome the difference in expected value. This finding represents a violation of rational decision making models, in particular the EUT's substitution axiom. Moreover, as in the original problem developed by Quattrone and Tversky (1988), the pair BC that is not consistent with prospect theory was in fact selected least often.

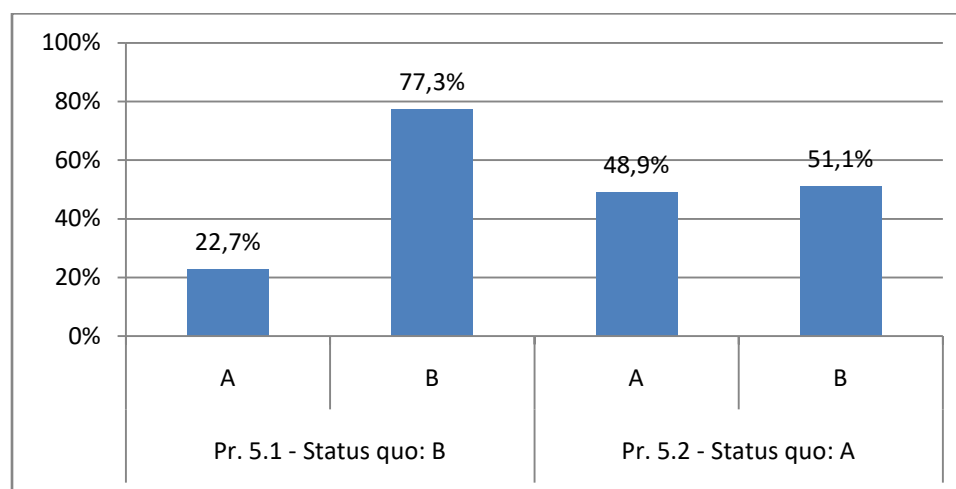
Overall these results suggest that rational choice theory cannot be supported in absolute terms in the case of this wicked sustainability problem. It has to be noted, though, that I found over 60% consistent choices with EUT, which is slightly superior to the responses in line with rational decision making (i.e., 49%) observed by Quattrone and Tversky (1988).<sup>2</sup> My results are also consistent with those found in previous work that replicates the original problems of Quattrone and Tversky (see Fatas et al., 2007).

<sup>2</sup> It has to be acknowledged that my data is not directly comparable to Quattrone and Tversky (1988) because they used a new cohort for each decision problem. In this study, the subjects were asked to respond to all the framing problems. I did not control for differential carryover effects or for practice effects.

### Status quo bias

Hypothesis 4 states that in decision making scenarios involving wicked problems the status quo tends to be preferred over alternatives with the same expected value. Problems 5.1 and 5.2 confirm a significant choice shift ( $\chi^2(1)=6.61$ ;  $p=0.01$ ) in a decision making scenario that involves a trade-off between economic and environmental goals. In problem 5.1, policy B represents the status quo and it was preferred by 77.3% of respondents, while the alternative policy A was supported by only 22.7% of participants. In problem 5.2, the status quo is represented by policy A and it was supported by almost a half of respondents (48.9%). Although it was not possible to find a bi-directional effect (choice reversal) as in the original problem of Quattrone and Tversky (1988), these results show a considerable increase –more than double– in the support to policy A when it is presented as the certain payoff (i.e., the status quo). In line with PT predictions, due to participants' loss aversion, the status quo policy is more highly valued than a policy that yields the same expected value. The status quo bias is therefore confirmed in this case as a significant unidirectional effect (choice shift).

**Figure 6.3. Status quo bias**



Source: own

### Support to policies based on contingency framing and outcome framing

Based on the work of Lee and Park (2011), Problem 6 tested in a single decision making scenario how outcome framing (i.e. gain or loss) and contingency framing (i.e., certain or uncertain) influence participants' responses and their support to policies to

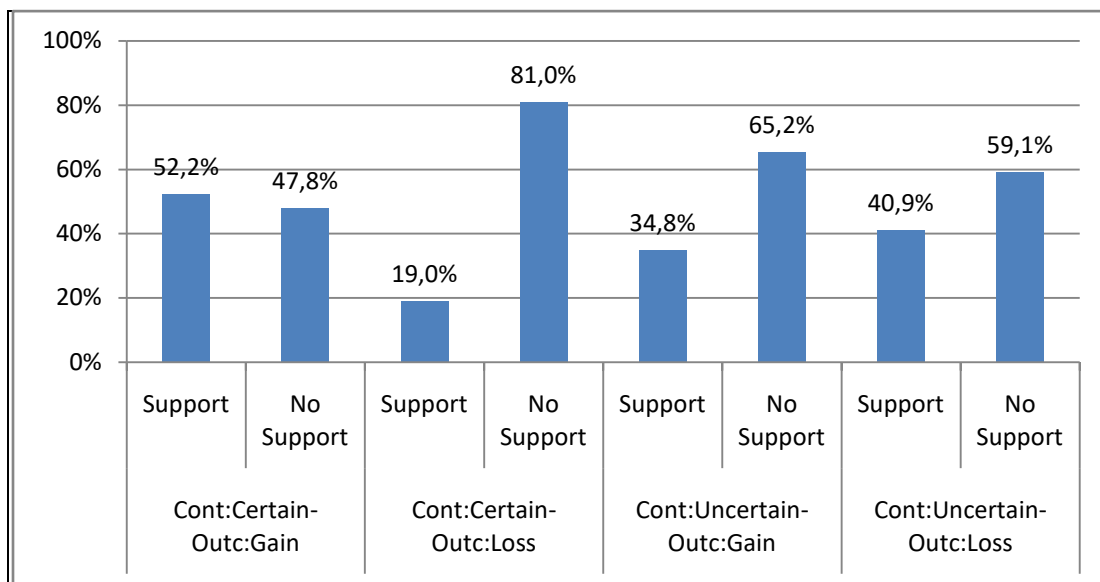
address a wicked problems. Based on PT's assumptions, H5(a) proposes that, in order to achieve support to a policy, framing outcomes as losses is more effective than framing them as gains; while H5(b) suggests that framing messages as certain is more effective in achieving support to policies than framing them as uncertain. Thus, H5(a) and (b) are focused on the main effect of each independent variable (i.e., both types of framing) on the dependent variable (i.e., the decision to support or not a solution). Alternatively, H5(c) indicates that there is an interaction effect between both types of framing on getting support to solutions to wicked problems. This means that the effects of outcome framing and contingency framing are not independent; therefore, the influence of one independent variable on the dependent variable may depend on the level of the other independent variable. Based on a 2x2 experimental design, four experimental groups were created and a logistic regression was used to test the hypotheses. See further details in Chapter 5.

Table 6.2 shows no support to H5(a) and (b), while it provides evidence of a borderline significant interaction between the two independent variables ( $p=0.053$ ). H5(c) is not rejected. Looking at Figure 6.4, apparently the best way of gaining support for a policy is to frame a message positively as a certain gain, whereas framing it negatively as a certain loss reduces support dramatically. Framing a message as an uncertain gain or an uncertain loss does not seem to have any positive impact on the levels of support.

**Table 6.2. Effects of types of framing on the level of support to policies**

		B	S.E.	Wald	df	Sig.	Exp (B)
Main effect	Contingency	-1.079	0.705	2.344	1	0.126	0.340
	Outcome	-0.261	0.616	0.179	1	0.672	0.770
Interaction effect	Contingency x Outcome	1.795	0.929	3.374	1	<b>0.053</b>	6.018
	Constant	-0.368	0.434	0.719	1	0.396	0.692

Source: own

**Figure 6.4. Support to policies (Contingency and Outcome framing)**

Source: own

**Attribute framing (accepting vs. rejecting)**

Problem 7 is inspired by a framing example whose effects cannot be explained by PT's loss aversion and the presence of risk and uncertainty but by the principle of compatibility (Shafir, 1993). According to this principle, the weighting of inputs (i.e., positive and negative attributes of potential solutions to a wicked problem) is enhanced by their compatibility with output (i.e., rejecting or recommending a solution). The positive and negative dimensions of options thus loom larger when one is choosing and when one is rejecting, respectively. Hence, options' advantages provide compelling reasons for choosing, while options' disadvantages provide natural reasons for rejecting.

Given two prospects, an enriched option with more positive and more negative features, and an impoverished option with fewer positive and fewer negative features, the compatibility principle leads to the following prediction: if positive features are weighted more heavily when choosing than when rejecting and negative features are weighted relatively more when rejecting than when choosing, then the enriched option could be both chosen and rejected when compared to the impoverished option. Shafir (1993) tested this proposition in hypothetical choices between monetary gambles, college courses, and

political candidates, finding consistent results in support of the compatibility principle. In the case of problem 7, however, I found an opposite reversal effect (Levin et al., 1998; Fatas et al., 2015) which is a significant choice shift/reversal contrary to theoretical accounts; in this case, contrary to Shafir's (1993) prediction.

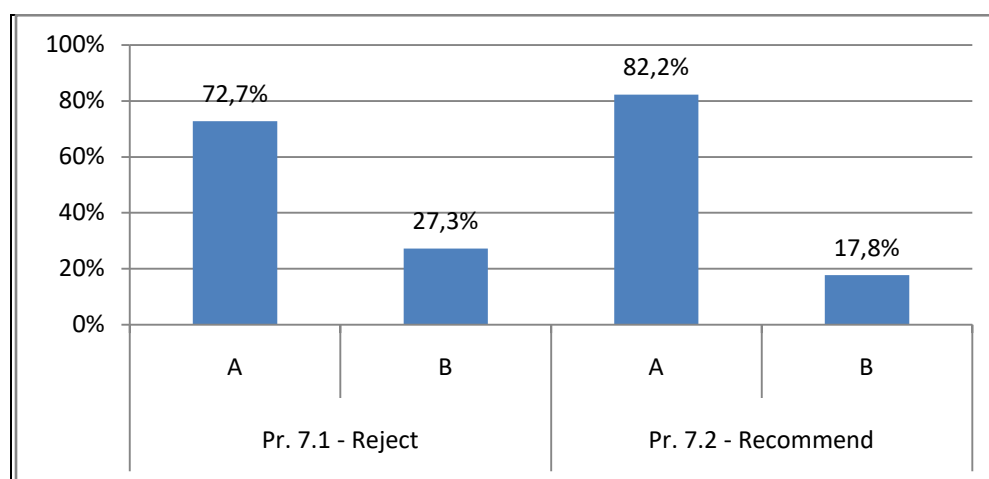
According to classical decision theory, in a binary choice situation where choosing and rejecting are seen as complementary tasks, it should not matter whether people are asked which option they prefer or which they would like to reject. It is expected that if people are rational and choose the first option they will reject the second option, and vice versa. If choosing and rejecting are complementary, and  $\pi_r$  and  $\pi_c$  respectively denote the percentage of subjects who reject and who recommend an option, on average the sum of  $\pi_r + \pi_c$  should equal 50%. On the other hand, if the rationale suggested by Shafir applies and the enriched option is chosen and rejected more often than the impoverished option, on average the sum of  $\pi_r + \pi_c$  should be greater than 50% for the enriched option and smaller than 50% for the impoverished option. As shown in Table 6.3 and Figure 6.5, I found that the average value of  $\pi_r + \pi_c$  for the impoverished option is significantly greater than the 50% that is expected if choosing and rejecting were complementary [(73+82)/2=77.5;  $z=5.189$ ,  $p<0.0001$ ], while the average value of  $\pi_r + \pi_c$  for the enriched option is significantly smaller than 50% [(27+18)/2=22.5;  $z=5.189$ ,  $p<0.0001$ ].

It is worth noting that although this opposite reversal does not confirm Shafir's hypothesis, it still represents a violation of EUT principles because the policy options presented to the participants are not ordered according to their attractiveness, with the more attractive selected and the less attractive rejected. Instead, the relative importance of options' strengths and weaknesses apparently varies with the nature of the task (Shafir, Simonson and Tversky, 1993). H6 cannot be verified as predicted; however, given the statistical significance of the opposite reversal, this problem provides evidence of an attribute framing effect that depends on what task the participants are required to do, regardless of which option they consider that has more pros and cons.

**Table 6.3. Attribute framing**

	Reject ( $\pi_r$ )	Recommend ( $\pi_c$ )	$\pi_r + \pi_c$
Project A (‘Impoverished option’)	73%	82%	155%
Project B (‘Enriched option’)	27%	18%	45%

Source: own

**Figure 6.5. Attribute framing**

Source: own

### Susceptibility to framing as moderating factor

Research Question 7 asks if people who are susceptible to framing effects in decisions involving loss of human lives and in consumer and financial contexts, they are also susceptible to framing effects in decisions involving wicked problems in the field of sustainability. In order to answer this question, I developed three scores for each participant to measure their susceptibility to framing. Susceptibility Score I ( $SS_I$ ) is based on the consistency of decisions made by each subject in parts 2 and 4 of the study (i.e., five pairs of ‘parallel’ framing problems in total). The score ranges from 0 (when all of the participant’s answers were consistent) to 1 (if all the answers were inconsistent). The higher the score, the more susceptible a participant is to framing effects. Susceptibility Score II ( $SS_{II}$ ) is based on the results of the sustainability problems no. 1 to 7 discussed above, which are compared against prospect theory’s predictions on framing effects.  $SS_{II}$  also ranges from 0 (if none of the participant’s answers were consistent with the predicted choices, given the provided frames) to 1 (if all answers were consistent with framing

predictions). Finally, Susceptibility Score III ( $SS_{III}$ ) measures framing susceptibility by analyzing the 10 parallel problems separately and comparing the participants' responses against theoretical predictions. The third score also ranges from 0 to 1 depending on the consistency of responses against framing predictions proposed in the original studies where the parallel problems were taken from (see Table 5.1). For further details on the susceptibility scores, please refer to Chapter 5.

A variety of tests have been performed to answer RQ7 based on the three measures of framing susceptibility. Table 6.4 presents the Pearson correlation coefficients between scores. In order to be consistent with common practices in statistical analysis, a significance level of 0.05 has been established to determine whether the correlations are significant. While  $SS_I$  shows no significant interaction with  $SS_{II}$  ( $p=0.475$ ) and  $SS_{III}$  ( $p=0.080$ ), there is a significant statistical correlation between  $SS_{II}$  and  $SS_{III}$  ( $p=0.050$ ).

This finding seems to support the argument of Lebouef and Shafir (2003) that a susceptibility measure based on consistency across frames (i.e.,  $SS_I$ ) is not a reliable measure of sensitivity to framing because people tend to adhere to normative principles (i.e., consistency) when their applicability is detected, but they often violate such principles when they are not detected. This means that some participants could be successful at avoiding inconsistent decisions –if they identified the similarities between problem in parts 2 and 4 of the study–, but not framing effects per se.

**Table 6.4. Correlation coefficients between susceptibility scores**

	$SS_I$	$SS_{II}$	$SS_{III}$
$SS_I$	1		
$SS_{II}$	0,0766	1	
$SS_{III}$	0,1861	<b>0,2080**</b>	1

The result of the correlation test in Table 6.4 shows a weak positive linear relationship that indicates that the susceptibility measures  $SS_{II}$  and  $SS_{III}$  tend to increase and decrease together. This is, participants who are

affected by framing manipulations when making decisions around non-wicked problems, also seem to be susceptible to framing effects in decisions involving wicked problems in the field of sustainability, and vice versa. More importantly, it is worth asking if people are affected differently by framing effects depending on what kind of decision they are asked to make. In other words, are participants more susceptible to framing effects in a decision making scenario than in the other?

In order to answer this question, I conducted a right-tailed t-test for paired samples using the two susceptibility scores that have a significant statistical correlation,  $SS_{II}$  and  $SS_{III}$ . I established the following hypotheses to verify if on average people are more affected by framing in decision scenarios involving non-wicked problems than in those involving wicked sustainability problems. The null hypothesis is  $H_0: \mu_D = X_{III}^- - X_{II}^- = 0$ , whereas the alternative hypothesis is  $H_a: \mu_D = X_{III}^- - X_{II}^- > 0$ . The assumption is that if people are equally affected by framing in both decision scenarios, then  $H_0$  cannot be rejected. Conversely, if participants are more susceptible to framing in the first (non-wicked) scenario than in the second one,  $H_0$  has to be rejected.

From the sample data, it is found that the corresponding sample means of  $SS_{III}$  and  $SS_{II}$  are  $X_{III}^- = 0.581$  and  $X_{II}^- = 0.5$ , and the standard deviations are  $s_{III} = 0.145$  and  $s_{II} = 0.204$ , respectively. If the difference between  $X_{III}^-$  and  $X_{II}^-$  is statistically significant, it would indicate that people are relatively more susceptible to framing effects when making decisions about non-wicked than on wicked problems. For the score differences, the values are  $D^- = 0.081$  and  $S_D = 0.225$ . Given a significance level of 5%, the critical value is  $t_c = 1.662$  ( $df = 88$ ). The computed t-statistic is 3.421; therefore, as  $t > t_c$ , the null hypothesis is rejected ( $p = 0.0005$ ): there is enough evidence to claim that people are more susceptible to framing effects in decisions involving loss of human lives and in consumer and financial contexts than when they make decisions around wicked sustainability problems. The immediate question is then: why are people less susceptible to framing effects around environmental sustainability issues than in other decision scenarios? The next section could shed some light on this question.

### **Protected values as moderating factor**

Research Question 8 asks if people holding protected values regarding the environment respond differently to framing manipulations in decision making scenarios involving sustainability problems than those people without protected environmental values. The main inputs to answer this question are the participants' responses to the questionnaire developed by Milfont and Duckitt (2010) to measure environmental attitudes. In total, 13 scales were employed to assess preservation and utilization attitudes regarding the environment using a 7-point Likert rating scale (1 = Strongly disagree and 7 = Strongly agree). The 13 scales are divided into Preservation factors (scales 1, 2, 3, 6, 8, 11, 12 and

13) and Utilization factors (scales 4, 5, 7, 9 and 10). For further details please refer to Chapter 5.

A variety of measures and tests were developed to answer RQ8. First, I checked the statistical correlations between the Environmental Attitude (EA) score and the three measures of susceptibility to framing. In order to do so, an individual factor score was initially calculated as the result of the value given by a participant to the positively worded item minus the value given to the negatively worded item in each of the 13 scales. Then, an individual EA score was calculated as the result of the total Preservation factors values minus the total Utilization factors values. The EA scores range from -7 to 63. It is assumed here that the higher the EA score, the stronger the individual environmental attitudes and, hence, the more a participant has protected values regarding the environment. As shown in Table 6.5, only SS<sub>II</sub> has a significant interaction with the EA score at a significance level of 0.10 ( $p=0.0914$ ). Although this correlation is not significant at conventional standards and the results could be statistically ambiguous, it is likely that with a bigger sample the correlation would be significant at  $\alpha=5\%$ .

The negative correlation between SS<sub>II</sub> and the EA score indicates that the stronger the environmental attitudes of the participants, the less susceptible to framing effect they are. This finding is in line with the work of Tanner and Medin (2004) who have proved that people with strong protected values are immune to framing when making decisions involving hypothetical environmental scenarios, while participants with few protected values show robust framing effects.

**Table 6.5. Correlation between susceptibility scores and EA score**

	EA Score
SS <sub>I</sub>	-0,0859
SS <sub>II</sub>	<b>-0,1800*</b>
SS <sub>III</sub>	0,0413

Second, the individual EA score was divided into a Preservation score (i.e., sum of individual factor scores for scales no. 1, 2, 3, 6, 8, 11, 12 and 13) and a Utilization score (i.e., sum of individual factor scores for scales no. 4, 5, 7, 9 and 10), and their interaction with the susceptibility measure SS<sub>II</sub> was also tested. The correlation between the Preservation and the Utilization scores is negative ( $r=-0.4484$ ), as expected, and statistically significant ( $p<0.001$ ). At  $\alpha=5\%$ , only the Utilization score and SS<sub>II</sub> have a significant statistical correlation ( $p=0.0383$ ). See Table 6.6. This positive interaction suggests that instrumental

values have relatively more weight on a person's susceptibility to framing than symbolic environmental values and ecological behaviours. This is, the stronger the instrumental values a person has regarding the environment, the more she is disposed to accept tradeoffs between ecological and economic values, and the more she is affected by framing manipulations when making decisions about environmental issues. Conversely, the weaker the instrumental values regarding the environment, the less affected by framing effects a person is.

**Table 6.6. Correlation coefficients between  $SS_{II}$  and Preservation and Utilization scores**

	$SS_{II}$
Preservation score	-0,1093
Utilization score	<b>0,2179**</b>

In order to confirm this difference between Preservation and Utilization scores, a Williams' T2 statistic has been calculated to verify if the correlation between  $SS_{II}$  and the Preservation score

( $r_{PSSII}$ ) is statistically different from the correlation between  $SS_{II}$  and the Utilization score ( $r_{USSII}$ ). Based on the results shown on Table 6.6, the null hypothesis is that  $H_0$ :

$r_{USSII} = r_{PSSII}$  and the alternative hypothesis is  $H_a$ :  $r_{USSII} > r_{PSSII}$ . Given a significance level of 5%, for a one-tailed test the critical value is  $t_c = 1.66$  ( $df = 86$ ). The computed t-statistic is 1.822; therefore, as  $t > t_c$ , the null hypothesis is rejected. As a response to RQ8, there is enough evidence to claim that participants with protected environmental values respond differently to framing manipulations in decision making scenarios involving wicked sustainability problems. Those with stronger utilization values and weak preservation values regarding the environment are more susceptible to framing effects than people with relatively weak utilization values and stronger preservation values.

## Discussion

In this chapter I have tested a series of hypotheses that confirm that key principles of prospect theory apply to risky decisions involving solutions to wicked sustainability problems. More specifically, I have demonstrated that participants of this experimental research ( $n = 89$ ) are affected by framing effects that cause shifts and reversals of preferences that are contrary to the predictions of classical normative theories of choice. I also analyzed two moderating variables that may explain people's sensitivity to such framing effects.

### **Loss aversion and reference point dependence**

Based on the results of problems 1.1 and 1.2, one major finding of this study is the confirmed tendency towards loss aversion (i.e., a bias in favour of risk-aversion in the positive frame and risk-seeking in the negative frame) and the reference point dependence, which are the cornerstone of PT as alternative theory of risky choice according to Tversky and Kahneman (1981). This means that prospects (i.e. policy options to wicked sustainability problems) are evaluated according to a value function that is subjectively oriented around a neutral value defining gains and losses (i.e., the reference point), exhibits diminishing sensitivity to probability differences as one moves away from the reference point, and it is steeper for losses than for gains. The facts that people will assume more risk to avoid a prospect framed as a loss than they will to obtain the identical prospect framed as a gain, and that policy considerations are not evaluated in an absolute way but with respect to a reference point, generate several cognitive and emotional biases. These anomalies –e.g., the endowment effect, the certainty effect or the status quo bias– have far-reaching implications for individual and organizational decision making (Mercer, 2005; Frey and Eichenberger, 1991). In fact, being a cognitive bias itself, loss aversion influences belief formation, preference for some arguments over others, information processing, and human behaviour in general.

Loss aversion not only operates at individual level, it can also have serious social and political consequences according to the way in which policymakers place value on potential losses and gains—both their own, and those of others— and make judgments about the fairness or appropriateness of a given risk management decision (Wilson et al., 2008). Whether individuals opt for taking a risk depends on their reference point: in the domain of relative losses, the risky choice is the loss-averse choice (e.g., the Asian disease experiment), while in the domain of relative gains, the safe choice is the loss-averse choice (Quattrone and Tversky 1988; Arceneux, 2012). Arguably, loss aversion may make individuals and/or societies unwilling to switch to healthier living due to the fear of loss income, in the same way that a risk-seeking attitude for likely losses can cause prolonged pursuit of doomed policies (e.g., the insistence on the “war on drugs” instead of the “war on addictions” to reduce substance abuse) or a risk-seeking attitude for unlikely gains can lead to quixotic policies (e.g., US President Donald Trump’s

obsession with repealing and replacing affordable health care ('Obamacare') despite the fact that a majority of US citizens support it; Kirzinger, 2017 and Norman, 2017).

Another comment on problems 1.1 and 1.2 has to do with the consistency of this study with the findings of the original Asian Disease Experiment and other works that have replicated this framing problem developed by Tversky and Kahneman (1981). Various researchers indicate that the more an experiment differs from the classic ADE problem, the less frequently they reveal preference reversals (see Fatas et al., 2007), or the magnitude of the effect tends to be smaller than the one found originally (Wang, 1996; Druckman, 2001). Wilson et al. (2008) even suggest that loss aversion may not be as broadly applicable to explain judgments made in social and environmental contexts because risks in those contexts may be evaluated quite differently when compared with those that may exist in a more easily quantifiable financial situation.

My study shows no support to those arguments. Problems 1.1 and 1.2 replicate the original ADE's probability structure, but they are substantially different in terms of the context of the decision (i.e., social housing rather than a life-and-death scenario) and the amount of people involved in the wicked situation (300 versus 600). Notwithstanding, the results obtained in this study are close to a perfect replication of the effects of the original problem, both in terms of significance and magnitude. This means that people are affected by loss aversion when they make hypothetical choices about life-and-death situations, and also when they make decision about social issues. A possible explanation for this finding is that housing affordability and homelessness are among the top priority concerns for the residents of British Columbia, the province where the experiments took place (see Vancouver Sun, 11/22/2016 and 6/10/2017). In this context, where most people are quite sensitive to the housing crisis in the province, any policy decision that involves displacing people from their homes without offering them a stable housing solution may be seen actually as a life threatening option. Replications of problems 1.1 and 1.2 in contexts where housing is not among the top public and political priorities may confirm or reject this explanation.

### **Ratio-difference principle**

As a consequence of loss aversion, problems 2.1 and 2.2 demonstrate that the ratio-difference principle holds when people make decision on wicked sustainability problems.

This means that participants order their preferences among policy solutions depending on how the outcomes and probabilities are described, thus violating the EUT principle of description invariance. The results show that people are more sensitive to outcomes described negatively than positively, and that the impact on perception is greater the larger the ratio of outcomes between the alternatives even though the two problems present equivalent choices. As explained by Quattrone and Tversky (1988), the ratio-difference principle is linked to psychophysics, which is “the study of the functional relation between the physical and the psychological value of attributes such as size, brightness, or loudness” (p. 728), which applies to many perceptual attributes. For instance, lighting a candle has more impact on illumination when initial illumination is poor than when it is good. According to prospect theory, this principle also applies to numerical differences (Quattrone and Tversky, 1988).

In terms of political behaviour, the ratio-difference principle has important implications as it challenges the assumption that people make decisions on wicked problems based on well-defined preferences. Problems 2.1 and 2.2 demonstrate that the decision of how to frame the data (*deforested* versus *protected* areas) can alter judgment about economic and ecological decisions, and has significant consequences. The apparently large difference between deforested areas of 10% and 5% (ratio of 2) can be reframed as a relatively small difference between protected areas of 90% and 95% (ratio close to 1). Because of the ratio-difference principle, this change in the framing of the problem increases significantly the support to the policy with the higher ecological impact, which was actually rejected by a vast majority of participants under the negative condition.

### **Certainty effect**

Problems 3 and 4 provide evidence that 30% of participants are affected by PT's certainty effect thus violating the substitution axiom of rational theory of choice. This finding confirms that when it comes to making decisions about wicked problems, some people have a non-linear probability weighting function and they value sure events different from risky events. More specifically, people tend to overweigh events of low probabilities, while over-proportionally under-weigh events of moderate and high probabilities. Therefore, a reduction of each outcome's stated probability by a common factor has a greater impact on the decision weight in the case of a certain outcome than

on a risky one. In dealing with real wicked problems, the certainty effect may operate to increase the perceived impact of rare events (thus focusing attention on such salient stimuli) while more subjacent, silent issues that generate cumulative negative effects over time remain unnoticed or are deliberately ignored.

### **Status quo bias**

Problems 5.1 and 5.2 confirm a choice shift in support of the status quo bias when participants have to choose between two policies that involve a trade-off between environmental and economic goals that were alternately framed to be the pre-existing position. The status quo bias represents a preference for the current state of affairs which is taken as a reference point, and any change from the current baseline is perceived as a loss.

According to prospect theory, the preference for the status quo is an emotional bias attributed to a combination of loss aversion and the endowment effect, which affects cognition and decision making (see Chapter 5). Due to PT's value function, which is steeper in the loss domain, people weigh the potential losses of moving away from the status quo more heavily than the potential gains they can obtain with a new state of affairs. As a consequence, most people will prefer to avoid change and stick with what has been done in the past (Samuelson and Zeckhauser, 1988). Part of the wickedness of this bias is the unjustified assumption that another choice will be inferior or make things worse.

Changes from the status quo typically involve both gains and losses, but a confirmed tendency to overemphasize the avoidance of losses favours retaining the status quo. Presumably, gaining a comparable option does not seem worth losing the option they currently possess (Levin et al., 1998). Thus, the status quo bias can also stress the adoption of the precautionary principle to risk management, which states that the introduction of a new solution whose ultimate effects are disputed or unknown should be resisted when extensive scientific knowledge on the matter is lacking. As indicated in Chapter 4, however, scientific uncertainty is inherent to sustainability and environmental decision making, and it should not be used as a reason for postponing new, risky measures to prevent environmental degradation.

### **Attribute framing**

Problem 7 shows no support to hypothesis Hypothesis 6 and the compatibility principle according to which the specific nature of the response scale tends to focus attention on the compatible features of the stimulus. Shafir (1993) predicted that options' advantages provide compelling reasons for choosing the alternative with more positive attributes (i.e., the enriched option), and thus make choices easier to determine and justify to oneself and to others, while options' disadvantages provide natural reasons for rejecting the alternative with more negative attributes (also the enriched option), which makes rejection easier to determine and justify. Shafir (1993) and Shafir et al. (1993) suggest that this “attentional effect” is realized as a shift in the weights applied to positive and negative attributes with a change in the task frame. As explained above, problem 7 reveals an opposite reversal effect that contradicts this theoretical prediction: when participants were asked to recommend or reject an option, under both framing conditions the majority chose the impoverished option instead of the enriched one.

One possible explanation for this finding is that the option that I assumed as the impoverished one was not deemed in the same way by the participants. It is worth noting that before running his accepting/rejecting experiments, Shafir (1993) asked an independent group of subjects to choose the enriched option as the option “that has more reasons for and against it” than the competing, impoverished option ( $p < 0.001$  in all cases). This is a procedure I did not follow and, in contrast, arbitrarily selected one option to be the enriched one and assumed that it would be recommended/rejected more often than the other one. It is possible, however, that some of the attributes of the impoverished option that I estimated as neutral were actually considered by the majority of participants as highly positive (e.g., little stakeholder opposition) or highly negative (e.g., little change to local employment). Consequently, the impoverished option may have been seen actually as the enriched one.

Notwithstanding the opposite reversal, it is fair to say that problem 7 still shows a significant framing effect but not in the expected direction. Given that the different tasks (i.e., rejecting or recommending) still make some attribute more salient than others, changing the task frame cause participants to selectively attend to the negative or positive

aspects of the prospects. This decision anomaly is not dependent on which option the participants consider as the enriched or the impoverished one.

### **Moderating factors: susceptibility to framing and protected values**

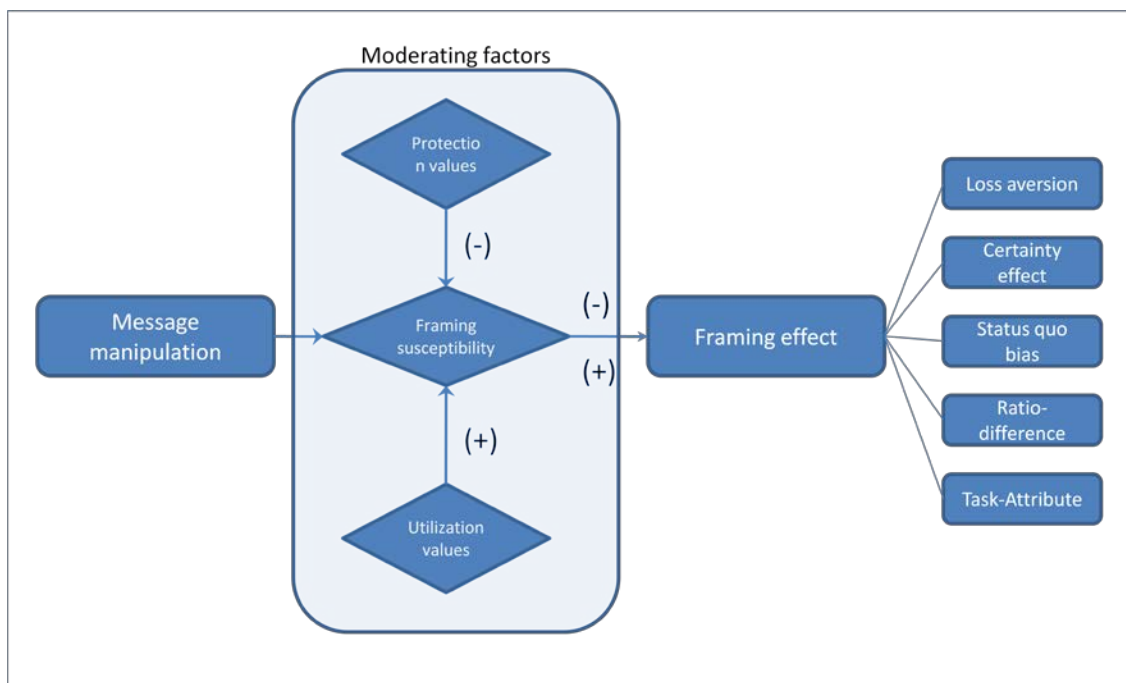
According to the susceptibility measures developed above, it has been demonstrated that participants are affected by framing effects in a variety of decision making scenarios, including consumer choices, life-and-death situations, as well as sustainability problems. The statistical tests also confirm that people are relatively more susceptible to framing in contexts involving non-wicked problems than in those about wicked sustainability problems. The explanation proposed here is that participants who give relatively more weight to preservation attitudes and ecological behaviours than to instrumental attitudes regarding the environment are less susceptible to framing effects when they make decisions around sustainability problems. As said above, this finding is consistent with the work of Tanner and Medin (2004) about the role of protected values in preventing framing effects about environmental decisions.

Looking with more details at the utilization and preservation factors that have a greater influence on people's sensitivity to framing, the correlation tests between each EA scale and  $SS_{II}$  reveal that only 3 out of the 13 environmental attitudes have a significant statistical relationship: scale 12 on the Preservation side, and scales 4 and 10 among the Utilization factors. Scale 12 shows participants' support for policies regulating the population growth and concern about overpopulation, versus lack of any support for such policies and concern. A significant negative correlation at  $\alpha=5\%$  ( $r=-0.2089$ ;  $p=0.050$ ) indicates that the more the participants express concerns about population growth and overpopulation, the less affected they are by framing effect when making decisions about sustainability problems. Conversely, on the Utilization side, a significant positive correlation between  $SS_{II}$  and scale 4 ( $r=0.2497$ ;  $p=0.0182$ ) and scale 10 ( $r=0.2176$ ;  $p=0.0405$ ) suggest that the more the participants agree with instrumental use of nature in favour of human beings, the more they are affected by framing effects. More specifically, scale 4 measures participants' support for conservation policies and protection of the environment motivated by anthropocentric concern for human welfare and gratification, versus support for such policies motivated by concern for nature and the environment as having value in themselves. Scale 10 measures support to the belief that economic growth

and development should have priority rather than environmental protection, versus the belief that environmental protection should have priority rather than economic growth and development.

The chart below provides a graphical representation of the relationship between both moderating factors (framing susceptibility and protected values) and framing effects.

**Figure 6.6. Framing effects and moderating factors**



Source: own

According to what has been exposed above, strong preservation values and weak utilization values regarding the environment thus offer complementary protection against arbitrary framing effects. People's attitudes about overpopulation, conservation and protection policies may have an important role in determining and predicting if, and how, they are affected by framing manipulations when dealing with wicked problems. Protected values may affect what evidence a person gathers to reinforce existing attitudes, they may also hamper opportunities for dialogue and debate with opposing views, and eventually they could reduce attention to information that may be potentially valuable but oppose to people's beliefs (Chong and Druckman, 2007).

## Conclusions

The last section of this chapter discusses some limitations of this experimental research and the study's contribution to extant research on protected values and framing effects. Other theoretical and practical implications coming from this study are presented in Chapter 9.

The two major limitations that may affect this study are the use of students as participants and the lack of focus on emotions. Regarding the first one, a common critique to experimental research on prospect theory that employs students as subjects is that it constraints the generalization of results because experienced decision makers (e.g., professionals, practitioners, political actors, policy makers) may have different risk attitudes and perception than (inexperienced) students (Fatas et al., 2015; Druckman, 2001; Lee and Park, 2011). If this argument is true and experts have a better perception of probability and risk than students, then it would be expected that professional decision makers would violate the principles of EUT less frequently. Studies that have contrasted the responses of both types of subjects, however, demonstrate that framing effects do not disappear with expertise, although it can make people a bit more rational (see Fatas et al., 2015; Linde and Vis, 2015). In other words, both expert decision makers and students subjects are affected by framing effects, but the former in a lesser degree than the latter. It is fair to sustain then that using students in this experiment should not limit the generalization of its results and that prospect theory's principles hold for a variety of decision makers when they have to decide how to solve a wicked sustainability problem.

Regarding the second limitation of the study, it has to be acknowledged that the focus of the analysis has been put on cognitive features and biases determining sensitivity to framing, while disregarding emotional aspects that are also key to understand how framing manipulations affects behaviour (Quattrone and Tversky, 1988; Levin et al., 1998; Mercer, 2005). Research on emotions and prospect theory, for instance, provides evidence that loss-framed arguments are more persuasive than gain-framed counter-arguments when individuals are in an anxious state (Arceneux, 2012; see also Nabi, 2003). Similarly, Druckman and McDermott (2008) have found that emotions significantly influence both individuals' tendencies to take risks and the impact of a frame on risky choices (e.g., emotions amplify or depress a frame's impact), depending

on the decision making scenario (life-and-death or financial decision) and the specific type of emotion under study (e.g., enthusiasm, anger or distress). Emotions, such as anger, may be also related to some properties of protected values as it has been proposed by Baron and Spranca (1997). In order to provide a more comprehensive understanding of framing effects on decision making and wicked problems in particular, my future research will need to integrate emotions into a research area traditionally dominated by more cognitive perspectives.

Previous research points out that protected values have also an impact on information processing and influence what aspects of a decision people consider to be relevant (Baron and Spranca, 1997). More specifically, people with protected values for environmental issues are more likely to increase attention to the commission of acts that damage the environment, and decrease attention to the outcomes of such acts (Tanner and Medin, 2004; Tanner, Medin and Iliev, 2008). People with protected environmental values show domain insensitivity (i.e., it is not relevant whether alternatives are associated with gains or losses, and risky or certain outcomes) which makes them less susceptible to be affected by outcome framing. The result of this study is consistent with previous literature on the topic and makes a relevant contribution to this field of research: it identifies which utilization values (scales 4 and 10) positively affect sensitivity to framing and which preservation value (scale 12) provides protection against framing manipulations.

## **Chapter 7. Case Study: Sustainability of Wild Pacific Salmon in British Columbia (Method)**

### **Introduction**

This chapter presents the research design for conducting an explanatory case study aimed at answering the third set of research questions established in the Introduction (Ch. 1): How does the attention process of public organizations on wicked problems emerge, develop, and (perhaps) eventually decay? More specifically, what are the main policy patterns that the attention process on wicked problems generates over time? What might be the outcome of this process? In order to address these questions, I focus on a specific wicked problem –the sustainability of Pacific salmon in British Columbia (SPS from now on)– and the policy responses deployed by the Department of Fisheries and Oceans (DFO) to deal with it during two attention cycles, 1990-1993 and 1994-1998.

Using Yin's (2003) typology of case studies (single case versus multiple case, and holistic case versus embedded), Study #3 can be categorized as a single, holistic case study. This is a single case as it represents a critical, unique phenomenon in two specific periods of time, whose findings are used for theory building, analytical generalization and comparison against extant theories of government attention. It has to be acknowledged that while single-case studies can richly describe the existence of a phenomenon, such as a wicked problem, multiple-case studies provide a stronger base for building theories that are more robust, testable and generalizable (Yin, 2003; Eisenhardt and Graeber, 2007). A single case study, however, can enable the creation of more complicated theories on rare or extreme phenomena than multiple cases. Single-case researchers can fit their theory exactly to the many details of a particular case, whereas multiple-case researchers retain only the relationships that are replicated across most or all the cases under examination (Eisenhardt and Graeber, 2007). Regarding the second dimension, this is a holistic case as it is concerned only with a public organization (the Department of Fisheries and Oceans) that is treated as a whole entity, instead of examining a number of its structural, logical sub-units.

This chapter is structured as follows. The next section describes the case study research design based on a process approach to government attention. It presents the unit of analysis, temporal dimension, and contextual level for the explanatory case study. The

third and four sections respectively describe the data collection technique and data analysis methodology, more specifically the event-structure analysis (ESA). The last section discusses the pros and cons of using ESA to conduct this study.

### Research method

A **case study design** is appropriate for this research due to at least two main reasons: first, it is able to build novel and empirically valid theory (Eisenhardt, 1989); second, it allows the identification of attention patterns and the way in which they fit within a wider context (Tsoukas, 1989). Consistent with the research questions above (i.e. a *how-question* about a contemporary set of events over which an investigator has little or no control; Yin, 2003 and 2009), I embrace the following definition of case study:

“A case study is a history of a past or current phenomenon, drawn from multiple sources of evidence. It can include data from direct observation and systematic interviewing as well as from public and private archives. In fact, any fact relevant to the stream of events describing the phenomenon is a potential datum in a case study, since context is important” (Leonard-Barton, 1990: 249).

The rationale behind the decision of conducting an explanatory case study is that it can address questions that deal with operational links that need to be traced over time. As it shown in Chapter 8, it provides important clues to cause-and-effect relationships that are relevant for this study –i.e., explanations of how certain events happened–, based on analytical explanation-building techniques and a rich and extensive data collection effort that facilitate theory testing (Yin, 2009).

Chapters 1 and 2 highlight that one of the main limitations of the extant literature on government attention is that this phenomenon is usually studied from a variance approach that is focused on the statistical relationship between inputs (independent variables) and outcomes of attention (dependent variable). On the contrary, a *how-question* as the one guiding this study is better addressed through an approach able to describe and explain the temporal sequence of events that unfold as organizational attention occurs, and gain a better appreciation of the dynamic aspects of a wicked problem. In accordance, the SPS case is analyzed adopting a **process approach** that aims to open the black box between

attentional inputs and outcomes; in other words, why and how certain issues (inputs) cause specific governmental responses (outcomes) in a specific time and space.

According to Pettigrew (1990), the explanation of outcomes of any organizational process needs to be based on the identification of an underlying logic that produces recurrent patterns, and the explanation of such patterns in particular chronological sequences. Building on Ocasio's (1997) work, a pattern of attention is conceived here as a reliable sample of actions, tendencies and/or observable characteristics of an institution (i.e., DFO), which helps discern a coherent attention process based on the intended interrelationships of its component parts (i.e., a particular set of events, problems, opportunities, and threats, and a particular set of skills, routines, programs, projects and procedures).

Analyzing pattern of relations and interdependence among variables is a critical task because it facilitates the understanding of how an organization achieves its goals, gives order to relevant organizational events (Weick, 1979), and defines the phenomenon being studied (Pentland and Feldman, 2007). In this case, the analysis of attention patterns over time in a systematic way facilitates the identification of key events and causal mechanisms that trigger policy responses, and the way in which they are embedded in a particular context, how they relate to one another, and how these interdependencies affect each of them. Thus, it is possible to develop a process approach to government attention able to generate idiographic causal explanations (Hager, 1998) that are concerned with the deterministic sequence of events or actions that results in, or influences, a particular outcome for a particular case and in a particular period of time.

As explained in Chapter 2, attention in organizations is a dynamic process that is not typically captured well by models that investigate the patterns of co-variation of organizational variables. Rather, methods that consider the roles that discrete events play in the unfolding of organizational life histories may be more useful in describing and understanding organizational processes (Hager, 1998). In this sense, I agree with Buttriss and Wilkinson (2014: 2) who consider that a process approach –in my case to government attention– is “much closer to the lived history of managers and policy makers, who do not manage variables, they initiate and respond to events.” According to those authors, process theories offer a better way of understanding and coping with the

complexity and dynamics of the systems in which policy makers and practitioners operate, and the role and importance of different factors, which are both critical for the study of wicked problems in the field of sustainable development (Buttriss and Wilkinson, 2014). Furthermore, a process view of organizational attention that examines patterns of relationships among events and seeks history-based causal explanations is in line with the critical realistic research paradigm adopted in this doctoral dissertation aimed at understanding relations between events and generative mechanisms that establish a specific causal link (Hussenot and Missonier, 2015). Based on Buttriss and Wilkinson's (2014) processual approach to organizational change, I understand a mechanism as a special kind of causal process that explains how entities and activities come about, and how actions initiate, operate and interact in a particular context resulting in a particular temporal sequence of events and patterns.

Building on previous research, the following basic aspects have to be taken into account when conducting a process case study: unit of analysis, temporal dimension, contextual level (Yin, 2003 and 2009). The appropriate **unit of analysis** that constitutes the focal point to studying organizational attention processes on wicked problems are the *events* and/or *sequences of events* that initiated and contributed to specific government interventions. The analysis of sequences of events allows identifying if the process of attention on a wicked problem develops through specific stages and which such stages are. To do so, the order and sequence of events for an attention cycle should be identified and compared with the event sequence of other attention cycles. The comparison of attention cycles can be made according to different criteria used for examining various characteristics of event sequences, such as event categories, duration, order and recurrence (Abbott, 1988).

It is worth mentioning, however, that organizational patterns are contingent (i.e., patterns are not fixed and are replete with possible alternatives; Pentland and Feldman, 2007) and parallel series of events may occur simultaneously (Ponti, 2012). Depending on the point of view of the researcher/narrator, an event sequence can thus have distinct boundaries (i.e., beginning, middle and end). It is therefore important to confirm, first, that a sequence or pattern of events in a government attention process actually exists; then, develop a clear and coherent narrative that explains how the sequence of events

unfolded as the process of attention emerged; and finally turn to questions about what the causes and consequences are of the events within the attention process pattern (Van de Ven and Huber, 1990). In terms of an organizational narrative, *coherence* has to be understood as unity of action or purpose, rather than just a chronology or description of disconnected events. According to Pentland and Feldman (2007), unity of purpose defines the function that one might ascribe to the narrative and makes the pattern of action recognizable and coherent. In other words, knowing that event A occurred before event B does not necessarily establish a relation between them; they need to occur sequentially as part of a coherent story. Building on the theoretical framework on government attention presented in Chapter 2, more specifically Ocasio's (1997) ABV approach, the events included in the sequences under examination are environmental, economic and social *issues* affecting the sustainability of wild Pacific salmon in BC, and *answers* adopted by DFO to address such issues, for instance, new policies and programs, action plans, commissions of investigation, consultative processes, etc.

Several authors have highlighted the utility of the concept of *event* as the basis for data collection and analysis in studies where the analytical focus is on the mechanisms and logics that explain regular process patterns, rather than on process outcomes (e.g., Weick, 1979; Weick and Daft, 1983; Van de Ven and Huber, 1990; Pettigrew, 1990; Pentland, 1999 and 2003; Pentland and Feldman, 2007; Sminia, 2009). An event can be broadly defined as “a concrete fact [...] a moment in which the activity and its organization are concrete and tangible” (Hussenot and Missonier, 2015: 9). Thus defined, an event can last a few seconds or several years, it can be divided into other events, and cannot exist except through its relation with other events that produce structure and order by reconfiguring established patterns. A more specific definition proposed by Zacks and Tversky (2001: 3) suggests the following archetype for an event: “a segment of a time at a given location that is conceived by an observer to have a beginning and an end.” Those authors conceive of events as dynamic objects that, as any physical object (e.g., a book), can be organized into partonomic hierarchies (i.e., parts and sub-parts with particular spatial configurations, such as a book's spine or front cover) and taxonomic hierarchies (i.e., kind-of relationships and types of similar/different objects, such as dictionaries, picture books or anthologies). Additionally, given its dynamic nature, an event

incorporates a temporal structure: it has boundaries in time and is necessarily ephemeral. In terms of a theory of attention this interpretation has two important implications. First, when processing an event, attention may be guided by conceptual expectations, prior experience with that class of event (taxonomy) and/or perceptual characteristic of the part of the event that has unfolded so far. Second, it also means that each event is a moment in time, and it can be experienced only once (Zacks and Tversky, 2001). This temporal perspective of events highlights transitions and dynamic changes from a stage to another stage of the process under examination.

In line with these definitions, instead of treating each critical event as a discrete unit of information, interpretation or meaning abstracted by a detached observer –i.e., a *particle event*–, I use the analogy suggested by Peterson (1998) who consider those particle-events as elements embedded in a process (i.e., a *wave*). The wave perspective indicates that in a process there are flows with specific *crest events* of high energy surrounded by a detectable pattern of preceding and following events. Adopting a wave perspective on interrelated critical events helps to analyze the governmental responses around those crests (i.e., the crisis generated by the events' cumulative effects that suddenly come to the fore and receive government attention), but also during those periods of apparent tranquility when crises are silently cultivated without being noticed by government officials, the media and the public. The idea of crest event is not novel; it is in line with Hendricks' (1972) definition of a narrative as a sequence of *functional events*, which are those that advance the plot and are connected with other events that do not happen in isolation. Similarly, Pentland and Feldman (2007) have used the concept functional events as departure point to develop an analytical device for representing organizational patterns. Their device, called *narrative networks* (Pentland and Feldman, 2007), emphasizes that actions can be interconnected in many different ways, making different stories and transforming the context and the nature of the things that are connected.

The understanding of events as dynamic objects occurring in a particular time and space leads to the consideration of another critical parameter for a process approach to government attention: its **temporal dimension**. This means, firstly, that the units of analysis –i.e. *issues* and *answers*– are taken to change in content and/or shape over time. This is a central consideration to explaining the course and the outcome of any

organizational process (Sminia, 2009). It is also particularly important for the analysis of a wicked sustainability problem in contexts characterized by constant local twists in market conditions, political alliances and stakeholders' participation in decision making processes. As shown in Ch. 4, dynamic aspects of a wicked problem determine the extent to which the problem and the solutions change or remain stable. This is, the more dynamic the wicked problem is, the more unstable the implemented solutions will be, even leading some sustainable solutions to turn into wicked problems themselves. Secondly, and consistent with the wave perspective described above, the temporal dimension indicates that the events under examination incorporate their predecessor and successor events that define the actual event. Finally, incorporating a temporal dimension into the analysis implies the need to establish the boundaries of a case history (i.e., where the event sequences begin and end) as a way to define the order and structure of events. Setting temporal boundaries is, however, merely an analytical strategy as we live in an ongoing present where people continuously re-signify past and actual events (Hussenot and Missonier, 2015).

In this study, I analyze and compare two cycles of attention: 1990-1993 and 1994-1998. The comparison of attention cycles helps to develop a longitudinal analysis of a single-case study in two different points in time, contributing to the analytical generalization of empirical results (Yin, 2009). The reason for focusing this research in the 90s is that, according to primary and secondary sources of information (see below), critical changes that demanded DFO urgent responses occurred in the salmon fishery locally and internationally during that decade, namely: shifts in ocean climate conditions, significant conservation concerns, serious decline in salmon abundance, a drop in world prices for salmon, and the introduction of new fisheries management approaches (DFO, 1999). As a result, DFO fisheries management practices experienced radical changes during the 90s: practices shifted to reflect new objectives such as reducing the by-catch of non-target species in various fisheries, and to respond to the general public's concern for preserving and restoring biological diversity (Pacific Fisheries Resource Conservation Council [PFRCC], 1999). The narratives for each cycle under examination are presented in the next chapter.

The **contextual level** of the study refers to the main locus in which causal powers interact and produce outcomes in a specific context (Tsoukas, 1989). In this regard, the analysis is focused on the policy subsystem where the federal Department of Fisheries and Oceans (DFO) acts in response to issues affecting the sustainability of wild Pacific Salmon. The literature suggests that a policy subsystem is defined by a substantive (wicked) issue –in this case, the SPS–, a geographic scope –i.e., the Fraser River watershed in British Columbia– and a set of stakeholders from different affiliations within and outside different levels of government –e.g., fishery groups, coastal communities, provincial government– (Sabatier and Jenkins-Smith, 1999; Weible, 2005; Cairney and Weible, 2015).

In this context, DFO has essential responsibility and authority in connection with the salmon fishery, including its management, monitoring, surveillance and enforcement. The responsibilities for managing salmon fisheries are assigned to DFO under section 91(12) of the Constitution Act, 1867, which gives the federal government jurisdiction over sea coast and inland fisheries. This jurisdiction is exercised by DFO that manages and controls fisheries through the provisions of the Fisheries Act and associated regulations. DFO's responsibility for and authority over sea coast and inland fisheries is the legal basis for the Department's primary objective to conserve the salmon resource by ensuring that enough fish of each species reach to spawning grounds so the salmon population can at least be maintained, if not enhanced. In order to do so, DFO has usually depends upon restrictions on fishing time, fishing gear, and fishing places to constrain catches and to ensure escapement. DFO is responsible for declaring the opening and closure of the salmon fishing season every year to allow the harvestable resource surplus to be taken and shared appropriately, while ensuring sufficient numbers of fish escape to spawn.

DFO's mandate, established under the Department of Fisheries and Ocean Act, includes responsibility for the conservation and sustainable use of Canada's fisheries resources. To address the need for conservation, DFO has an extensive science branch, with research institutes in various locations across the country. The science branch is responsible for providing evidence for the need of conservation of various species, which are then regulated by the Department. In BC, DFO has a complex internal fisheries

management system that reflects geographical differences and diversity of interests involved in the various stocks of salmon.

### **Data collection**

In order to examine the longitudinal development and intertwinement of critical issues related to the SPS and DFO's answers, I use a strategic narrative approach that is useful for developing and refining theory (Stryker, 1996). The term narrative describes an accounting of a chronological, sequential progression of events, which focuses its content around a single coherent story (Hager, 1998; Stevenson and Greenberg, 2000; Pentland and Feldman, 2007). More specifically, Griffin (1993: 1096) defines a narrative as "an analytic construct that unify a number of past or contemporaneous actions and happenings, which might otherwise have been viewed as discrete or disparate, into a coherent relational whole that gives meaning to and explains each of its elements and is, at the same time, constituted by them." This means that a narrative has an interpretative character that depends on how the narrator uses data to construct a particular sequence of events for a particular purpose. In this case, the use of a narrative approach contributes to the accumulation of knowledge on attention processes and wicked problems, and to uncover attention patterns and stimuli that might escape our current understanding of this phenomenon because they are absent from extant theories of attention in the public sector.

Given that more than one causal explanation may be valid and there may be problems of assuring the objectivity of the observer in the reconstruction of events and narratives, it is important to consider many possible sources of evidence. The goal of triangulating different sources is to support the relevance of events, verify the connections between them, and assure the accuracy and robustness of the chronological sequence of events under examination (Heise, 1989; Stevenson and Greenberg, 1998). To reconstruct a narrative for each attention cycle studied here, I interviewed experts on matters related to the SPS in British Columbia, and collected official government documents, information publicly available (e.g., memorandums, news releases, reports, etc.), and news articles of the Vancouver Sun and the Globe and Mail related to the case. In order to construct a narrative that aggregates several points of view, I used in total 70 texts for the two cycles of attention under examination (22 in the period 90-93 and 48 in the period 94-98) and

conducted 15 semi-structured interviews with experts from governmental and non-governmental institutions, who were identified using a snowball sampling technique. The interviews were conducted between February and July, 2013.

Inspired by Flanagan's (1954) Critical Incident Technique, the interviewees were asked to describe a variety of critical events (i.e., environmental events; legislation, treaties, policies and/or plans; social events; and economic events) they have experienced or observed, which had the most positive and negative long term effects on the sustainability of the Pacific salmon in the last 30 years. The idea of identifying critical events in a 30-year time frame was to avoid a possible disadvantage of using Flanagan's technique, namely: a built-in bias toward incidents that happened recently since these are easier to recall, but which are not necessarily the ones that made a critical contribution –either positively or negatively- to the phenomenon under investigation. The information provided by the interviewees was used to identify the events mentioned more often and to determine the temporal dimension for this case study (see above). The interview guide is presented in the Appendix H.

### **Data analysis**

Data analysis is conducted in three main steps: (i) descriptive analysis of each attention cycle under examination; (ii) use of event structure analysis for search of associations among issues (attentional inputs) and answers (attentional outcomes); (iii) search for patterns across attention cycles. What follows is the explanation of these steps.

(i) For each attention cycle, I build a descriptive narrative structured as a record of *issues* that were likely to have contributed causally, or have influenced, specific governmental *answers* concerning the SPS. Based on the information collected from primary and secondary sources, the narratives include only the events that appear to be potentially causally important to a specific DFO intervention. Consistent with the search of idiographic causal explanations and the definition of narrative consistency, what is relevant to the conceptual understanding of events and their causal perceptual structure is the relationship between goals, causes and outcomes (Zacks and Tversky, 2001; Hager, 1998). This is, how an alleged cause has influenced a particular outcome, considering also the counterfactual question whether an outcome could have occurred had the cause not preceded it.

(ii) After the descriptive narratives are constructed, I analyze them to determine causal links between critical issues and government answers. Following Hager (1998), I distinguish *proximate causes* from *intervening causes* as a way to separate primarily causal factors in a chain of organizational events –i.e., precipitating causes– from non-causal factors –i.e., additional consequences of initial precipitating causes. More specifically, a proximate cause is one that sets in motion a chain of events that leads to the outcome(s) of the attentional process (e.g., a new policy) and is near in time and place between an action and its outcome. An intervening cause is an event that stems from a proximate cause and participates in the chain of events leading to an attentional outcome –either significantly interrupting the chain of events set in motion by an action or at least substantially contributing to the outcomes–, but it is not an event that sets the chain in motion (Hager, 1998).

To analyze and unpack each narrative I use Heise's (1989) **event-structure analysis (ESA) methodology** that, with the assistance of the computer algorithm ETHNO,<sup>3</sup> produces graphic representations of the causal connections among events introduced in each narrative as a means to identify patterns of interaction between issues and answers. ESA has been applied initially in sociological and historical analysis, and it has been also extended to organizational studies to examine processes and transactions that form an organization (Heise and Durig, 1997; Hager, 1998; Stevenson and Greenberg, 1998 and 2000; Ponti, 2012). To my knowledge, this is the first study that uses the ESA methodology to analyze organizational attention patterns on wicked problems.

The ETHNO software causally links events in a systematic way and produces a diagram of the event structure, which is basically defined as the way in which past and future events take place to make an actual event possible (Hussenot and Missonier, 2015). ESA is thus focused on how each event enables and expands other events, allowing the researcher to develop a methodological approach to social reality that is based on a rigorous methodology and to build more realistic process theories (Heise, 1991; Abbott, 1992; Buttriss and Wilkinson, 2014). For each event chronologically entered in a narrative, ETHNO asks a series of Yes/No questions about whether a temporal antecedent is necessary for a subsequent event so that the causal connections

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<sup>3</sup> ESA can be downloaded from the Internet at <http://www.indiana.edu/~socpsy/ESA/>

can be established.<sup>4</sup> There are four types of elicitation questions that can be selected to conduct the analysis: 1) prerequisite (i.e., does Y require X or a similar action?); 2) implications (i.e., does occurrence of X imply Y or a similar action?); 3) historical causation (i.e., is X or a similar action a cause of Y in the circumstances that existed?); 4) counterfactual (i.e., suppose an action like X does not occur. Can Y occur anyway?). The four types of questions are logically equivalent: answering *Yes* to the first three questions, or *No* to the counterfactual question indicates that the two actions are linked; answering *No* to the first three questions, or *Yes* to the counterfactual question indicates that the two actions are not linked.

In this case, ESA is conducted using historical causation questions. The resulting diagram shows an *implicational structure* –i.e., a graphical display with nodes and lines representing events and causal connections between events, respectively– which helps identify the events that are pivotal in a certain process (Heise, 1989 and 1991). This feature is particularly useful for analyzing the cumulative effects of wicked problems and attention patterns they generate as ESA diagrams can show the convergence on key events and diagrammatically clarify what leads to a turning point in an attention cycle.

It is important to mention that ETHNO does not produce the causal connections that make up the diagram. It can only probe the researcher for interpretations of data and deductions about the causality between events. The program depends on the researcher having the knowledge about the relations between events to make the decisions that will produce the diagram of causal connections. Event sequence analysis thus requires intimate knowledge of the local situation in which the process takes place because the researcher needs to be able to envisage the actors' reasoning when they decide on the next action for the researcher to be able to make a judgement on whether and how one event has lead to another (Griffin, 1993). My role as a researcher is to identify key events, define logical causal relations among them, and to determine how each event enables and expends other events. The fact that the resulting structure is an artifact of the

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<sup>4</sup> Ethno can ask the question in several different ways but the default relational question is: Does the current-action require a specific prior-action or a similar action? The phrase "or a similar event" is in the relational question for a good reason: sometimes an action has substitute prerequisites, any one of which will do. The researcher should answer "yes" to the relational question if the prior action can act as a prerequisite even if another action could serve as an alternative (Heise, 2012).

researcher's decisions about which events to enter into the software and how they are causally linked explains in part why it is important to triangulate different sources of information and to integrate different points of views into the narrative.

(iii) Each graphical model coming from the two narratives is employed for comparison in order to uncover patterns and regularities (i.e., similar findings) across the attention cycles under examination. These findings are used, firstly, to understand why and how DFO attends issues affecting the SPS under certain circumstances during each attention cycle and, secondly, for purposes of contrast, abstraction and analytical generalization. Yin (2009) defines analytical generalization of case studies as empirical results that are generalizable to theoretical propositions (e.g., expanding current theories), rather than inferences made about a population on the basis of empirical data collected about a representative sample (i.e., statistical generalization). Based on this chain of observing, representing and analyzing patterns of events, I intend to identify the logics, mechanisms and contingencies that helped or restrained DFO to focus and sustain attention on the SPS, and what the outcome of such process is. In this analytical step, abstract analysis and theoretical conceptualization are required, as well as an account of the contingencies within which the causal links have taken place. The goal is to postulate the existence of generative mechanisms that are potentially responsible for the occurrence of the events and outcomes under study. The abstraction and generalization of patterns help to make inferences based on the replicable analysis of sequences of events and not just dependant on the researcher's intuition (Griffin, 1993; Ponti, 2010). Following the structure of the descriptive narrative, the key here is to reduce the long and detail accounts of events to short sequences of abstract classes of issues and responses which occurred during each stage of the attention process.

In line with this last analytical step aimed at searching for patterns and generalizing results, it is worth discussing how the reliability and validity of this study will be assessed. I use Lincoln and Guba's (1985) model of naturalistic inquiry and their notion of trustworthiness that consists of four criteria: credibility, transferability, dependability and confirmability. First, credibility talks about the need of establishing the believability of qualitative research results through a rich and thick description of the case being analyzed (e.g., settings, actors, procedures, interactions, temporal boundaries and

contextual characteristics). In this study, the credibility of findings is supported by a detailed description of the SPS as a wicked problem and the explanation of policy responses adopted by DFO, which are both based on the triangulation of primary and secondary sources of information (see next chapter).

Second, transferability means generalization of qualitative research findings to other settings. The search for patterns across cycles of attention is in fact aimed at finding regularities that can be analytically generalized (Yin, 2009) to other similar contexts and/or wicked problems, and contrasted against extant theories of attention. I use an inductive approach to make theoretical inferences and comparison with rival, mainstream theories of attention out of the evidence collected through different sources.

Third, the dependability criterion is based on the possibility of replicating this study by other researchers and finding similar results –i.e., same understanding of the phenomenon or same constructs in similar settings. In this regard, it is important to document and provide records of each step of the research process –as it is done in this chapter and in Appendix I– so other observers/researchers can conduct a “confirmability audit” (Lincoln and Guba, 1985) to evaluate the research process, including its procedures, the reliability of methods and the validity of results. The use of ESA methodology helps to reach inferences that, although they are generally interpretative in nature, are strictly replicable: a reader can know exactly the causal interpretations and (often) the logical, empirical and theoretical reasons for them, and can directly challenge any aspect of the analysis, from the selection and written description of the sequences of events to their inferred significance and causal connectedness (Griffin and Kostard, 1998).

Finally, the confirmability criterion is similar to the concept of objectivity in quantitative research and it is directly linked to the previous notions of dependability and credibility. Objectivity in qualitative research, however, can be problematic because the researcher exercises subjective judgments to interpret data and make claims about the meaning of the data. The triangulation of information sources helps to reduce personal biases and possible discrepancies between observations and inferences on which the narratives are based. Similarly, ESA’s question-and-answer routine explained above contributes to maintain fidelity with the interrogatory spirit underlying historical causal

reasoning that requires the researcher to interrogate and cross-examine events for evidence of causal significance (Griffin and Kostard, 1998).

## **Conclusions**

Several authors have highlighted the contribution of a narrative approach to the study of organizational processes. It is useful for inferring causal relations between particle-events and also for investigating how those interrelated events unfold over time, why something happened in the organizational process under examination, and how individuals understood those events (Maitlis and Sonenshein, 2010; Stevenson and Greenberg, 1998 and 2000; Ponti, 2012). This is particularly relevant for the study of the wicked dimensions of a sustainability problem given that a narrative approach allows the inclusion of multiple points of view, multiple understandings and potentially multiple conflictive goals (Pentland and Feldman, 2007). Talking more specifically about the ESA methodology, it offers a systematic way of describing and analyzing how and why things change in terms of temporal sequences and causal mechanisms that underlie the connection between attentional inputs and outcomes. Thus, ESA allows building more realistic process theories of the dynamics of attention on wicked problems, and provides a novel conceptual and methodological lens for analyzing and visualizing emerging patterns of attention.

It worth mentioning, however, two important limitations of this study that need to be taken into account when considering its findings and contributions to theory and practice. First, when conducting ESA, it is usually recommended to have multiple researchers and/or coders involved in the examination of event sequences in order to improve the reliability of their interpretation, abstraction and generalization (Ponti, 2012). As with the qualitative systematic review presented in Chapters 3 and 4, this third study is a one-man job and may be unintentionally affected by personal biases. It is then possible that not all readers agree with my identification and conceptualization of events, patterns and contextual conditions. The triangulation of sources of information and the integration of different perspectives on the problems affecting the SPS are aimed at reducing such potential discrepancies. Nevertheless, it has to be acknowledged the partial character of the data sources used here. On the one hand, interviews are not objective descriptions of original events but the participants' constructions of the same. As the identification of

critical events often rely on memory, incidents may be imprecise or may even go unreported. On the other hand, used documents as secondary sources can be biased both through selection and reporting, and while they allow recovering sequences of events, it is not possible to recover the significance of those events for the involved actors.

Second, the focus on a single, very unique and context-specific wicked problem –the SPS in BC during the 90s– may raises questions about the possibility of generalizing results to a larger population and/or to a process theory of attention. Although I am aware that the analysis of alternative, multiple cases may increase the heterogeneity of data, this study is not meant to be a sampling research able to provide statistical representation of the study population and/or to learn about other cases. As mentioned above, my goal is to discern variations and regularities with respect to extant theories of government attention and to generate rich details and further theoretical understanding of the phenomenon being studied, stipulating a presumed set of causal links between the events under examination. The research design presented in this chapter provides the tools to accomplish this task.

## **Chapter 8. Case Study: Sustainability of Wild Pacific Salmon in British Columbia (Findings)**

### **Introduction**

This chapter presents the findings of the Event Structure Analysis (ESA) conducted on two attention cycles, which describes how and why government attention on wicked sustainability problems emerges, develops and decays, and which attention patterns and outcomes are generated. As it is further explained in Chapter 7, the goal of this third study is to develop a process approach to government attention in order to generate idiographic causal explanations able to explain sequences of events that resulted in, or influenced, governmental responses to deal with a particular wicked problem in a specific place and period of time. Using an explanatory case study research design and a narrative approach to data analysis, this study is focused on the sustainability of wild Pacific salmon in British Columbia, Canada and the responses deployed by the federal Department of Fisheries and Oceans (DFO) during 1990-93 and 1994-98.

The study contributes to overcoming theoretical limitations of the extant literature on government attention –mostly focused on well-defined critical events, as accidents and natural disasters– to address with very complex, uncertain, dynamic and conflictive, long-standing societal issues. The systematic analysis and comparison of two attention cycles uncover factors and regularities that might escape our understanding of this phenomenon because they are currently absent from mainstream theories of organizational attention. Building on the work of Ocasio (1997), Van de Ven and Huber (1990) and Abbott (1988), government attention is conceived here as an observed, coherent sequence of discrete actions taken by DFO (e.g., action plans, commissions of investigation, policies, programs, etc.) and underlying generative mechanisms and/or patterns that occurred as a response to a series of societal events affecting the sustainability of wild Pacific salmon in BC.

The chapter initiates with a description of the selected case as a wicked problem and the two attention cycles under examination in the second and third sections, respectively. Then it presents the findings of a three-step analytical procedure: (i) development of the two narratives describing the attention cycles; (ii) use of ESA methodology for identifying connections between issues (attentional inputs) and answers (attentional

outcomes) in each attention cycle; (iii) comparison of attention cycles and search of attention patterns across cycles for purposes of abstraction, theoretical conceptualization and analytical generalization. The fourth section showcases the two descriptive narratives and the graphic representations generated by the ESA methodology and the supporting ETHNO software. The fifth section is dedicated to the comparative analysis of the attention cycles, while the discussion of findings and conclusions are presented in the last two sections, respectively. Appendix I presents the log of ETHNO's questions and my answers that the software uses to link events in each attention cycle. This is essential for replication by other researchers and for the readers to understand my interpretation of the events under examination.

### **Case selection: the SPS in British Columbia as a wicked problem**

The sustainability of wild Pacific salmon in British Columbia has been selected as case study because it fits the description of wicked sustainability problems according to four wickedness dimensions that integrate conceptual framework presented in Chapter 4: Stakeholders divergence, Co-existing uncertainties, Institutional complexity, and Environmental dynamism (see Table 4.10).

In terms of stakeholder divergence, salmon fishing in BC involves three main users groups (commercial, recreational and aboriginal fisheries), each of them having fundamentally different interests and points of view regarding what should be done to accomplish the conservation of salmon, who should be responsible for ensuring that conservation goals are met, and how the surplus production over that required for conservation should be allocated among user groups (Fraser River Sockeye Public Review Board [FRSPRB], 1995). Further complicating the problem, there are indirect users, such as the coastal communities, individuals and industry who use the salmon habitat and may reduce salmon abundance.

Regarding the institutional complexity of this wicked problem, the Pacific salmon fishery involves a huge number of different stakeholders whose many views and interests must be considered when DFO makes important policy decisions. The institutional framework for managing fisheries is an intricate web of federal and provincial laws and policies, aboriginal rights, international treaties and consultative structures. There are many participants to monitor and rules to enforce. In BC, more specifically, the

management of salmon fisheries involves a complicated mosaic of agencies, including: DFO, the US-CAN Pacific Salmon Commission, commercial fishery organizations, and the bodies associated with the Aboriginal fishery, among others. In terms of intergovernmental relations, the federal and provincial governments have distinguished, non-overlapping jurisdictions on the management and regulation of salmon as a resource: DFO cares about fish in the ocean before they arrive to the land, but when the fish is caught and crosses the line that separates the ocean from the dock it becomes an item of trade; then, the provincial jurisdiction starts. It has to be noted however that, although the provincial government does not have jurisdiction over salmon fisheries, almost everything the provincial government does has an impact on salmon. What happens inland from the high water mark is heavily influenced by how the province manages its resources (rivers, land, water), and even out in the open ocean there is a heavy influence of the province resource management (e.g., nutrients washing down the Fraser River that end in the Strait of Georgia).

A further complication is the constant presence of co-existing scientific and ecological uncertainties. Salmon eggs hatch in fresh water, but salmon spend most of their lives in the ocean before migrating back upstream to spawn. The current scientific knowledge about the lives of salmon in open ocean is quite limited, making changes of ocean productivity regimes difficult to predict. The estimates of sizes of stocks while still at sea are always uncertain since information about them is not usually available and reliable. Large discrepancies between the planned and achieved numbers of spawners (i.e., adult salmon returning to their home stream to lay its eggs and die) are unusual but not rare in major salmon fisheries. These discrepancies remind us that salmon management is “an imprecise science” (Pearse and Larkin, 1992: 31) and that forecasts of salmon returns are always associated with a level of uncertainty caused in part by unanticipated changes in the environment and/or unanswered scientific questions about these changes on salmon production (May, 1996).

Regarding the dynamic aspects of this wicked problem, salmon stocks are notoriously variable, fluctuate wildly and often unpredictably. They are dramatically affected by rapid changes in the freshwater and/or marine environment, such as rises in water temperatures, whose impacts affect annual salmon production and make it hard to

accurately forecast abundance of salmon (Pacific Policy Round Table [PPRT], 1995; May, 1996; Matkin, 1997). In turn, potential changes in salmon stocks have a significant impact on the province's economy and previous experiences show that such changes could spark new conflicts over the share of the resource between interest groups (The Globe and Mail, 12/23/92). As a result, fishery managers face special difficulties reconciling the natural requirements of highly sensitive migrating stocks with changing laws, governmental policies and social needs. Any management strategy or model that has any hope of being reasonably effective and efficient must indeed be able to function within these exceedingly uncertain and variable conditions (PPRT, 1995).

In general terms, achieving the sustainability of Pacific salmon in terms ecological conservation and economic utilization represents “one of the most complex problems of fisheries management; and nowhere is it more complicated than in the Fraser, the world's most productive salmon river” (Pearse and Larkin, 1992: 5). The Fraser is the longest river in British Columbia, stretching 1,375 km and supporting five species of wild Pacific salmon (i.e., Chinook, Coho, Pink, Chum, and Sockeye), each comprising several stocks that must be managed individually (The Canadian Encyclopedia, 2017). The five species of salmon in BC come from 4000 genetically distinct stocks that spawn in 1500 rivers and streams, which are very sensitive to habitat disturbance, climatic changes and oceanographic changes. The *sustainability challenge* for DFO's fishery managers is twofold: on one hand, they need to ensure that enough fish of each stock of each species reach their spawning grounds in order to maintain the population (i.e., conservation of the resource); on the other hand, they have to allocate the surplus among the competing groups of fishers to make salmon fisheries economically viable (i.e., utilization of the resource). Each of the three main users groups (commercial, recreational and aboriginal fisheries) has however potential demands placed on the resource that cannot be easily satisfied (May, 1996).

At the heart of this wicked problem there is resource scarcity, worsened by an ever-increasing efficiency within the commercial fleet –responsible for 80% of the catch– and environmental issues that pose a challenge to fisheries managers in their attempt to make salmon stocks sustainable over time. Further complications are raised by the fact that wild Pacific salmon is managed as a common pool resource (McKean, 2000; Ostrom,

2000) –it is indeed *owned* by the people of Canada– which can create incentives for a tragedy of the commons-type of problem if there is open access to salmon. In extreme cases, this can result in commercial depletion of the resource.

### **Cycles of attention under investigation**

Two cycles of attention, 1990-93 and 1994-98, will be first analyzed separately and then compared to each other in order to find patterns of attention across cycles that will be later used for purposes of abstraction and analytical generalization. The decision of focusing the analysis in those two cycles is that, according to primary and secondary sources of information, a major shift in global salmon markets and fisheries began in 1990, having consequences for salmon fishery management in BC until our current days.

In the late 80s, a combination of a rise of fish farming in places like Norway and Chile, which increased salmon supply from aquaculture, and of abundance of wild harvests made salmon prices fell sharply (PPRT, 1995; Sprout, 1997). This situation put pressure on the BC commercial fishery to become more productive, to reduce the costs of harvesting salmon, and to improve the quality of wild salmon caught (Matkin, 1997; Muse, 1999). Additionally, during the early 90s the economy of Japan –an extremely important world salmon market– experienced recurrent recession and financial crisis. While the problems in the Japanese market were temporary, the explosion in the production of farmed salmon and the impact it had on the salmon prices were permanent (Muse, 1999). After 1989, the landed value of BC salmon tended to drop, reaching in 1995 its lowest level since 1969. During the first half of the decade, the average annual landed value of the commercial salmon fishery was just over \$200 million. In contrast, in the 1995-99 period landed values were in the order of \$50 to \$100 million (DFO, 1998b). Similarly, BC went from 14% to 7% of world salmon production and no longer commanded a price premium (PPRT, 1995). This rapid turnaround caused stress and adjustment in the BC salmon fishing industry. As the prior higher prices were used to fuel capital cost addition and higher debt loads, many salmon fishermen felt financial pressure and only a reduced number were expected to achieve economic viability over time (PPRT, 1995). Market problems were also coupled with concerns about some fish stocks, particularly Coho salmon. In BC, Coho catches declined in almost every year after 1990 (Muse, 1999).

Moreover, in 1990 the Supreme Court of Canada determined that Aboriginal people have first priority access to the fishery, at least for food, social and ceremonial purposes. The order of the Supreme Court, known as the Sparrow Decision (further explained below), introduced the Aboriginal fishery as a new user group in an already complex management system, which had important consequences for years to come. Similarly, during the 90s the recreational fishery in BC grew in economic importance and political influence in detriment of the commercial fishery, the largest user of Pacific salmon resource (May, 1996; Pacific Fisheries Resource Conservation Council [PFRCC], 1999).

The first attention cycle under examination initiates with the Sparrow Decision in 1990 and ends with the record sockeye run of 1993. During this period, under the Progressive Conservative governments of Prime Ministers B. Mulroney and K. Campbell, three Ministers of Fisheries and Oceans (MFO) were appointed: Bernard Valcourt (02/90 to 04/91), John Crosbie (04/91 to 06/93) and Ross Reid (06/93 to 11/93). The second attention cycle starts with the disappearance of several millions of sockeye salmon at the beginning of the 1994 fishing season and finishes with the Coho crisis of 1998. This cycle covers the Liberal administration of Prime Minister J. Chretien and three appointed MFOs, Brian Tobin (11/93 to 01/96), Fred Mifflin (01/96 to 06/97) and David Anderson (06/97 to 08/99).

The interviews conducted for this study reveal that personal and professional backgrounds of the MFO of the day influence the priorities of the Department; for instance, D. Anderson is well-known for his strong pro-conservation approach to fishery management in comparison to other Ministers who were relatively more oriented towards the economic interests of commercial fisheries. This observation is in line with J. Kingdon's (1984) influential book on the way policy problems emerge in government, which suggests that those at the top of organizational hierarchy set the agenda of the government and determine what they themselves will and will not pay attention to. The rationale behind the analysis of attention cycles across two different federal administrations and six MFOs is to find organizational attention patterns and outcomes that cannot be explained necessarily only by personal, ideological characteristics of those on top of the hierarchy of the Department, but as the result of a policy process in a

particular policy subsystem where other actors, within and outside government, can influence the way in which the process of attention unfolds over time.

### **Narratives and ESA**

What follows are the narratives and event structure analysis (ESA) for each attention cycle. The narratives include only those events (i.e., environmental, economic, legal and social issues) that appear to be potentially causally important to specific government interventions (answers) during the period of time under examination. Although issues and answers overlap in reality, they are presented in a linear way only for the purpose of organizing the narratives. Each narrative was constructed by triangulating primary and secondary sources of information.

The ESA methodology has been applied using a historical causal analysis to discover how the events in each narrative are connected logically. The ETHNO software implementing ESA generates a chart showing the prerequisite structure of events based on my responses to historical causation questions (i.e., is X or a similar action a cause of Y in the circumstances that existed?). The resulting diagrams help to explain how a wicked problem evolved over time, to identify proximate (i.e. direct) and intervening (i.e., indirect) causes of specific government interventions, and to discern a consistent attention pattern across cycles under examination.

### **Attention cycle 1990-1993**

The decade of 1990 initiated with an important order of the Supreme Court, known as the **Sparrow Decision**, that had critical consequences for the management of fisheries in Canada, and for salmon fishery in British Columbia in particular. This landmark case involved a member of the Musqueam Band, Ronald E. Sparrow, who was initially convicted of fishing illegally with a net longer than was permitted by his food fishing license. His arrest and subsequent court case led the Supreme Court of Canada to determine that, after conservation needs are met, Aboriginal people have first priority access to the fishery for food, social and ceremonial purposes.

The Sparrow decision forced the Government of Canada to respond to a partly-defined and evolving Aboriginal right to fish protected by the Constitution. In 1991, the federal government launched the **Aboriginal Fisheries Co-operative Management** program

which enabled native groups to become involved in fisheries management, enhancement and habitat improvement activities. The program involved around 150 agreements (costing \$11 million) with Aboriginal communities across Canada. After extensive consultation with both industry and Aboriginal groups, on June 29<sup>th</sup> 1992, DFO announced the **Aboriginal Fisheries Strategy (AFS)**, a 7-year plan (\$140 million) to introduce needed changes in order to address the Supreme Court order through active consultation and engagement of native people in managing fish resources. The AFS was thus designed “to stabilize the fishery while increasing economic opportunities for First Nations” (DFO, 1992).

The main instruments for applying the new AFS were **Agreements** between DFO and Aboriginal groups. In 1992, more than 80 agreements (worth \$14 million) on fisheries management and fishing rights allocations were concluded with Aboriginal bands throughout BC. The agreements, which represented an 80% funding increase compared to 1991 and covered about 75% of the Aboriginal people in BC who had traditionally fished salmon, included everything from stock enhancement and habitat restoration to training of native fishery guardians, resource assessment and economic development. DFO also introduced **pilot projects** to test the commercial sale of fish harvested under communal licences by Native groups, which was prohibited since 1888. Of the 97 Indian bands along the Fraser River system, only the Musqueam, Sto:lo and Tsawwassen bands reached agreements with DFO allowing them to sell an allocated number of fish. Other bands retained their traditional right to fish only for personal and ceremonial uses.

On August 1992, after estimating that about **150,000 of the prized Early Stuart salmon had gone missing** before their arrival to the spawning streams in central BC, **DFO abruptly ended the sockeye salmon fishing season** on the Fraser to let the stock pass through lower Fraser. It was later calculated that in total 482,000 sockeye salmon failed to reach their spawning grounds in the Fraser River system for reasons that could not be attributed to wrong estimates of the number of fish entering the river or their normal natural mortality. With the first reports of the shortfall in spawners, DFO and the new fishing Agreements became targets of **criticism**. The high expectations for the 1992 sockeye salmon management as a result of a long-term stock rebuilding program were not being realized, causing much anxiety among fishers and raising concerns about

meeting escapement targets. Accusations of poaching, abuse of fishing agreements and incompetence by DFO were rife. The inability of the DFO to prevent poaching along the Fraser caused **animosity between the commercial fishing industry and native groups** who initiated a **media war** against each other.

A widespread perception developed that the fisheries on the Fraser River were “out of control”. The media reported alarming activity on the river, commercial and sport fishing groups expressed disapproval, the public began to lose confidence, and the **DFO’s competence was questioned. Fishermen and fishing organizations protested** and demanded a federal inquiry to investigate such low return to spawning areas. On September 15<sup>th</sup> 1992, hundreds of angry commercial fishermen sailed their vessels through several B.C. harbours (e.g., Vancouver, Nanaimo, Ucluelet) to back demands for a judicial inquiry into dwindling salmon stocks, alleging mismanagement by the DFO and massive overfishing by Aboriginal fishermen. Commercial fishermen requested the federal government to cancel the pilot project allowing the sale of fish caught by native Aboriginal groups. In Ottawa, however, DFO Minister John Crosbie said he would have considered a special inquiry into the low number of Fraser River salmon only if he was not satisfied with his own **department's investigation**, and insisted that B.C. salmon stocks were not in danger (The Globe and Mail, 09/16/92). DFO’s West Coast regional director-general, Mr. Pat Chamut, explained to the press that the shortfall was probably the results of a combination of factors: an underestimation of the catch by the legal Aboriginal commercial and food fishery, the possibility of error in predictions of the salmon run, poaching by both natives and non-natives, and unexplained deaths of fish as they migrate to the spawning grounds (The Globe and Mail, 09/01/92).

On September 17<sup>th</sup> 1992, two days after the fishermen’s protest, in order to clear the air Minister Crosbie appointed Drs. Peter Larkin, a fisheries scientist from the University of British Columbia, and Peter Pearse, a resource economist also from UBC, as **independent advisors to conduct a thorough investigation** of the circumstances explaining the discrepancy in the estimates of expected and actual spawners, and to recommend needed improvements in the fishery management system. DFO organized a team of more than 50 experts to provide Drs. Pearse and Larkin with a great deal of technical information and analysis upon their requests. The independent advisors met

with representatives of the fishing industry, commercial fishermen, sport fishermen and Aboriginals, and with many individuals, some of whom were not directly involved in the fishery but who were concerned about the salmon or witnessed events on the river the summer of 1992.

After two months, Pearse and Larkin concluded their investigation and identified a series of special circumstances and events during 1992 that further complicated the management of Fraser salmon: 1) **weather disturbances** due to El Niño's warm water current and a hot, dry summer, which caused fewer Fraser fish, sockeyes arriving later than usual and stress to migrating salmon. 2) **Breakdown in international coordination** under the Pacific Salmon Commission. For the first time in history, the Canadian and US governments failed to agree on how the commercial catch at sea would be divided between Canadian and US fishermen. This caused fisheries authorities in each country to design independent plans for fishing stocks bound for the Fraser, thus raising the prospect of a "fish war" (i.e., competitive fishing on the same stocks). 3) **New Aboriginal Fisheries and pilot sale projects on the Fraser River** created a "special problem" for DFO's fishery managers (Pearse and Larkin, 1992: 6). According to the investigation's report, enforcement arrangements under the new Agreements were unclear and DFO personnel and resources were not adequate, thus weakening the regulatory power of its enforcement officers.

Drs. Pearse and Larkin found that the main reasons for the shortfall of 1992 was that the mortality among sockeye before they reached their spawning grounds was somewhat higher than normal (on average 10% higher), due in part to heavy **exploitation of gillnet fishing** in the river and **continuous, unregulated and uncontrolled fishery**. Their conclusion was that "the bulk of the missing fish can be explained by fishing in the river...[However] we cannot say who took the unrecorded catch, whether they were Indians or not, what portion was taken in the Agreement area, how they were disposed of, or where they went. Nor can we say whether they were caught illegally. We can only say with confidence that considerably more fish were taken than estimated, many more died as result of intense fishing activity, and much of the catch was sold illegally insofar as official sales slips were not issued for them" (Pearse and Larkin, 1992: 28). They also

concluded that the Agreements, although successful in regulating the Aboriginal fishery in some areas, showed to be inadequate to control catches and ensure escapement.

Drs. Pearse and Larkin recommended a series of conditions as prerequisites for successful co-operative management: a) Communication to avoid lack of reliable information, confusions, poor internal communication at DFO); b) Consultative structures with a variety of advisory bodies and councils concerned with fisheries in BC; c) To avoid agreements that led to difficulties, such as the lack of preparation for implementing them, inadequate consultation with field personnel and the differing treatment of Aboriginal communities; 4) Urgency of careful planning before any new agreements were struck.

On December 7<sup>th</sup> 1992, DFO Minister J. Crosbie released the **Action Plan in Response to the Report on the Fraser River Salmon Investigation** to address Drs. Pearse and Larkin's conclusions and recommendations. Based on their report, the Action Plan (AP) highlighted that: the conservation of salmon was not threatened by the events of 1992, although it was a setback compared with the targets set for the year; the events of the summer generated considerable concern, "some of it wildly exaggerated;" and unless improvements were made in the manner of implementing the government's policy measures affecting Aboriginal people, serious conservation concerns could result. In his statement on the AP, Crosbie accepted that DFO made mistakes in implementing the AFS but confirmed the course of action in regard of the Aboriginal fisheries: "1992 was a startup year and we will learn. The strategy's policy approach is sound and balanced. It will be continued" (DFO, 1992: 3). Minister Crosbie directed DFO to take action in the following areas: 1) consultation; 2) negotiation of Aboriginal fishing agreements; 3) an enforceable management system for the aboriginal fisheries; 4) commercial licence retirement.

1) Consultation. Crosbie agreed with Pearse and Larkin's recommendation on an allocation framework embracing the whole Fraser watershed as the most reasonable basis for agreements with Aboriginal groups on Fraser salmon allocations and management. Crosbie invited all 97 chiefs of the Fraser River First Nations to come up with a process for a collective solution to issues of allocation and disposition of catch for 1993. Also

DFO continued to work with BC FN Summit to establish an ongoing consultative body to deal with broader issues and overall management of Aboriginal fisheries.

2) Negotiation of Aboriginal fishing agreements. Since 1992 was the first year of the AFS, consultations on policy development overlapped with negotiations of individual agreements, as well as with the internal discussion of Native groups and other to establish their own structures for consultations. Crosbie admitted serious delays in 1992 but DFO took measures to avoid similar problems in 1993, viz.: negotiations for agreements started early in January in order to be finalized by early spring; internal re-organization of the DFO staff to ensure that the negotiations could progress quickly and that communication throughout DFO would be improved at all levels; provision of public status reports to the industry on discussions and all agreements; expansion of the DFO test sale projects to some additional areas of BC but with the assurance that no agreements were negotiated without appropriate enforcement measures to ensure compliance with their terms.

3) Building an enforceable management system for the Aboriginal fisheries. DFO's Action Plan recognized a variety of enforcement and implementation issues surrounding the AFS that generated **uncertainty, confusion and controversy** regarding the legal status of Aboriginal fishermen in various part of the river, such as: the wide diversity of conditions under which Aboriginal fisheries in the Fraser Watershed were managed; DFO's failure to convince Native leadership that a watershed agreement was the most sensible way to proceed; and DFO's failure to reach management agreements with all groups. "This confusion seriously **undermined enforcement** efforts and must be corrected through increased rigor in all aspects of DFO's management and enforcement of in-river fisheries," admitted Minister Crosby (DFO, 1992: 5). In order to avoid these problems, the Action Plan proposed a series of measures aimed at: improving control in Aboriginal fisheries; regulating fish buyers; developing an enforcement protocol to ensure comprehensive monitoring of Aboriginal fisheries; increasing presence of fishery officers and Native fishery guardians to improve monitoring and enforcement efforts; providing training for DFO fishery officers and 50 Native guardians on AF management and enforcement issues to ensure greater compliance with agreements; and additional hydro-acoustic monitoring of migrating salmon.

4) Voluntary commercial licence retirement. The BC Fisheries Commission developed a \$7 million pilot program accepted by DFO to neutralize impacts that could result from incremental reallocation of fish resources to Aboriginal fishermen due to the AFS. If Native fishing opportunities required expansion, commercial fishermen who wanted out of the fishery would have been properly compensated and no increased pressure on the fishery would have resulted.

DFO's Action Plan announcement prompted an **angry response from non-native commercial fishermen** who have alleged massive overfishing by the natives and wanted the Department to cancel the program. Outside the press conference where Mr. Crosbie announced the Action Plan there were calls for the government to abandon commercial salmon-sale agreements with natives. Organizations representing fishermen, the industry and unions protested against the expansion of native fishing rights and the destruction of the commercial industry. They predicted that the province would suffer because of lost taxes from non-native fishermen, and called the agreements an "ill-advised strategy" to purchase land-claim settlements at the expense of non-native fishermen (The Globe and Mail, 12/08/92). On the contrary, aboriginal fishermen argued that despite the efforts of industry spokesmen to blame natives for the disappearance of the fish, the Pearse and Larkin's report did not find natives specifically responsible. DFO assistant deputy minister of policy and program planning, M. Flumian, admitted that the Department had not much choice but to continue negotiating the agreements with aboriginal groups for the right to sell fish as a way to anticipate potential court decisions on this matter (The Globe and Mail, 12/09/92).

On March 26<sup>th</sup> 1993, Mr. Crosbie announced the **Fraser and Skeena River Management Plans** that, by incorporating Pearse and Larkin's recommendations, virtually **doubled enforcement levels** during the 1993 salmon fisheries season. Increased enforcement, coupled with comprehensive watershed-wide management plans, was aimed to ensure the orderly conduct of salmon fishing so that spawning goals were realized, obligations to aboriginal people were met, and allocations to all fishing groups were achieved. Resources for enforcement, including the costs of more intensive land, water and air patrols, were increased by \$1.2 million on the Fraser system and by \$621,000 on the Skeena. As recommended by Pearse and Larkin, improvements were

also made in the methodology used by DFO for in-river counts of salmon, and in the assessment of factors that influence the natural mortality of salmon returning to spawn. Two months later, on May 20<sup>th</sup>, Crosbie announces that **bilateral fishing agreements** between DFO and Aboriginal bands were going to be negotiated across all major BC watersheds to secure river-wide control of Aboriginal fisheries were in place for the Skeena and Fraser Rivers before major salmon runs arrived, as recommended in the Pearse and Larkin report. The watershed agreements, that incorporated Aboriginal bands in the various management and enforcement structures, were supported by integrated management plans, including new components to monitor numbers of fish and gauge stress on fish.

In the international arena, on June 18<sup>th</sup> it was announced that negotiations under the **CAN-US Pacific Salmon Treaty broke down again** with no agreement on the number of salmon each country was entitled to take during the 1993 fishing season. Following a threat by Canada to go a second consecutive year without an agreement, a week later the Canadian federal government announced a one-year agreement under a **new CAN-US Pacific salmon treaty** to limit American harvesting of Canadian salmon stocks and protect the interests of Canadian fishermen. “It will enable Canada to manage its salmon fisheries with **certainty** and **stability** in 1993,” said Mr. Crosbie in a news release (The Globe and Mail, 06/25/93). Under the accord, the U.S. catch of B.C.'s Fraser River sockeye salmon in Washington state waters was limited to 2.8 million fish (down from 7 million fish over a four-year period under the previous agreement), while Canada agreed to limit its Coho salmon troll harvest off the west coast of Vancouver Island to 1.7 million fish, a reduction from the previous ceiling of 1.8 million. The federal government called the new Pacific salmon treaty “a victory for Canada”, but some representatives of the British Columbia fishing processing industry were branding the deal with the United States a sell-out, a price way too high for international peace (The Globe and Mail, 06/25/93).

On June 1993 also, the **B.C. Court of Appeal ruled there was no aboriginal right to sell fish**, but **Ottawa signalled clearly that it was going to proceed with its program** to extend commercial fishing opportunities for natives despite the court decision. DFO Pacific regional office announced an increased allocation of the coveted sockeye salmon

catch to several native groups taking part in pilot projects allowing them to sell a portion of their catch. The allocation accompanied predictions by DFO officials that the 1993 salmon catch would be a near-record one of more than 40 million fish. In the Fraser River alone, it was expected to be nearly three times the 1992 level of 6 million fish.

**The reaction from non-native fishermen was however one of outrage.** They maintained that the federal government was selling them out in the interest of settling land claims, that reallocations of commercial fishing rights to natives were arbitrary and discriminatory, that there was no longer any basis or argument to suggest that there was an aboriginal right to a commercial fishery, and that DFO could not control the Aboriginal fishery (The Globe and Mail, 07/10/93). At the end of the salmon fishing season on October 1993, however, even the strongest opponents of the federal aboriginal fisheries strategy were admitting that their dire predictions failed to come true amid the **richest sockeye salmon run in 80 years**. A spokesman for the Fisheries Survival Coalition, which systematically opposed any reallocation of commercial fishing rights to natives, acknowledged that the heated rhetoric about the AFS and the pilot sale project “faded in the public eye, certainly amongst some of the fishing community” (The Globe and Mail, 10/28/93). In an atmosphere of abundance, the Director of DFO Pacific region Aboriginal Fisheries branch, Mr. Paul Kariya, said to the press: “At the grossest level, the aggregate level, this was a far better year than last. It was a hell of a lot better, and it wasn't just because there was lots of fish [...] I think we can safely say our escapement targets have been met or exceeded in all our runs [...] **We're in great shape**” (The Globe and Mail, 10/28/93). The 22.7 million-fish sockeye run of 1993 –the largest since a 1913 rock slide in the Fraser River devastated many stocks– was indeed expected to be exceeded in 1994. For Mr. Kariya, a bigger issue than the native fishery in fall 1993 was the decision of the four major processors to stop buying sockeye and pink salmon in the face of a price dispute and a glut of salmon on the market. But that is another (wicked) problem.

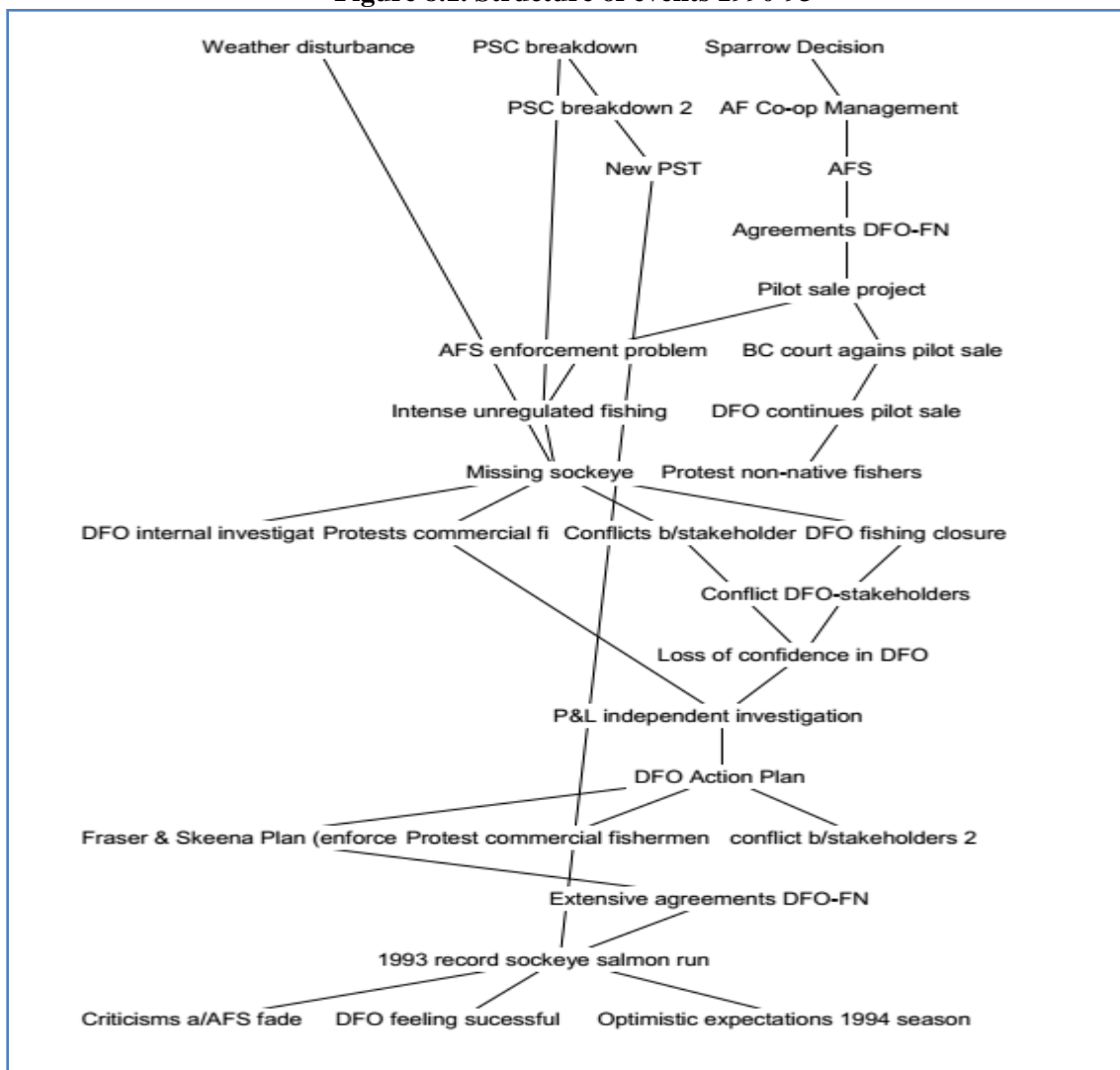
### **Event Structure Analysis of attention cycle 1990-1993**

The following chart is a graphic representation of the causal structure of events affecting the sustainability of wild Pacific salmon between 1990 and 1993 according to the narrative provided in the previous sub-section. The chart shows relations among

events, viz.: societal and ecological issues and government answers. Each node represents an event, whereas lines connecting nodes show historical causal connections between an antecedent action (i.e., a cause) and a subsequent action (i.e., a consequence). Thus, the chart reflects a logical (rather than temporal) implicational structure: this is, occurrence of the bottom action in the chart implies occurrence of the top action. In other words, the action at the top of the line is a prerequisite for the action at the bottom, and the bottom action cannot occur until after an occurrence of the top action (Heise, 2012).

After all the historical causation questions were answered, the resulting diagram was tested for logical inconsistencies using ETHNO’s testing function (see Heise, 2012). The 1990-93 structure of events is as follows:

**Figure 8.1. Structure of events 1990-93**



Source: own

The chart shows, firstly, how a wicked problem silently evolves until it is attended by the government. Natural disasters, industrial accidents or terrorist attacks –the focus of mainstream theories of organizational and government attention– are usually well-identified in time and space (e.g., the September 11<sup>th</sup> 2001 terrorist attack to the World Trade Center in NYC); in other words, it is possible to determine how, when and where such critical events took place, started and finished. A wicked problem is, on the contrary, a symptom of other (wicked) problems whose effects –not easily identifiable in time and space– cumulate over time until they create a societal/ecological crisis that triggers a series of formal interventions not always consistent and well coordinated. In this case, the direct, proximate cause of the sequence of governmental responses that goes from the events **P&L independent investigation, DFO Action Plan and Fraser and Skeena Plans** through to **Extensive agreements DFO-FN** in Graphic 9.1 is the disappearance of hundreds of thousands of sockeye salmon (i.e., **Missing sockeye** event). This is, in turn, the result of a combination of indirect, intervening causes, such as climatic changes (**Weather disturbance**) and an exploitative, unregulated in-river fishing caused by the lack of international cooperation for managing salmon fishing (**PSC breakdown**) and a badly implemented AFS (i.e. sequence of events that goes from **Sparrow Decision** to **AFS enforcement problem**).

The logic, immediate questions a reader may raise are: why had DFO not paid attention to these issues before? Why did DFO wait for a crisis to happen before taking action? The analysis of this attention cycle reveals that government responses are mainly focused on critical events that generate a high degree of conflict among stakeholders (in this case, fisheries user groups) and between stakeholders and DFO, which usually receive a lot of media coverage. Such conflicts, in turn, negatively affect the public confidence in the government to fulfill its constitutional mandate (i.e., protection of salmon stocks and control of fisheries). Events that do not produce a great deal of conflict and/or do not significantly undermine public confidence in governmental institutions are more likely to receive less attention than those that do so. As an example, a spokesman for the Sto:lo Indians' Lower Fraser Fishing Authority (LFFA) interviewed by the media around the 1992 missing sockeye event said that native fishermen warned DFO months before the crisis about allowing unregulated fishing on the Fraser to the north of their territory.

However, DFO provided no financing for monitoring fishing and salmon catches beyond the northern edge of the Sto:lo fishing boundary (The Globe and Mail, 10/06/92). Only when competing interests waged a media war against each other, and the news reverberated around Ottawa and Victoria, the Pearse and Larkin investigation was announced.

The chart above also helps to discern how DFO attention process on this wicked problem evolved from 1990 to 1993 according to the following sequence of events:

1. The cumulative effects of a series of interrelated issues of different nature create a **crisis** that generates **protests** and **conflicts** between stakeholders and among stakeholders and DFO, receiving a great deal of media coverage. In the case of the missing sockeye event, the crisis was variously interpreted as evidence that the new AFS was a failure, that it threatened livelihoods, and that it was the leading edge of reckless policy change. For DFO officials, on the contrary, the AFS and the pilot sale project were means to meet constitutional obligations with Aboriginal people and to restore their right to sell their catch as a result of the Sparrow decision (The Globe and Mail, 09/01/92 and 09/16/92). "We're changing history" said the DFO deputy fisheries minister to the press when he was asked about the experimental sale program (The Globe and Mail, 09/01/92).
2. The government firstly establishes **internal procedures and/or structures** to investigate the ecological crisis ('DFO internal investigation' in Graphic 9.1), and uses instruments at hand to tame it ('DFO fishing closure'). In this case, DFO's West Coast regional director-general said to the press that protesting commercial fishermen were reacting to "rumour and innuendo, not facts", and that DFO was conducting an investigation to find out why salmon returns were unexpectedly low, "certainly a concern to the Department" (The Globe and Mail, 09/16/92).
3. Implemented measures and the internal investigation, however, cannot solve the problem. **Protests and conflicts** between stakeholders and among stakeholders and the government escalate, negatively affecting **public confidence** in government in general, and in fisheries management in particular. In this regard, the spokesman of the BC Fishermen's Survival Coalition said to the press that the blame of the missing sockeye crisis rested squarely with the DFO: "There have

been programs put in place without proper monitoring [...] That's DFO's responsibility. They can't put programs into place without proper management” (The Globe and Mail, 09/16/92). Moreover, during the closure of the fishing season in 1992, non-native commercial fishermen, processors and sports-fishing groups filed a legal claim asking the B.C. Supreme Court to declare the aboriginal fishery illegal and unconstitutional. The coalition claimed that the deputy fisheries minister and other federal officials failed to supervise the fishery adequately or at all, and as a result of their failure or refusal to discharge their statutory and constitutional obligations, the fishery was in peril (The Globe and Mail, 09/01/92). Chief Justice William Esson, however, refused to hear the claim while the fishery remains closed. The conflicts and discrepancies between native and non-native fishers continued. The biggest single obstacle to progress in developing a new policy was indeed “the widespread perception that fisheries on the Fraser were out of control” (Pearse and Larkin 1992: 19).

4. DFO establishes **external procedures and/or structures** to investigate the crisis and regain public confidence (‘P&L independent investigation’ event). In the midst of major protests from different user groups, MFO Crosbie admitted to the press that the Department would have initiated an independent special inquiry only if he was not satisfied with DFO’s internal investigation (The Globe and Mail, 09/16/92). Consistent with this argument, the independent report clearly stated that “the deficiency in Ottawa’s role is underlined by the need for this investigation in the first place” (Pearse and Larkin, 1992: 32).
5. **Investigative capacities are assigned to an independent body** that, by implementing a consultative process, frames the triggering crisis (i.e., missing sockeye) and makes a series of recommendations. In this case, Pearse and Larkin’s investigation was unable to identify exactly who the responsible were for the exploitative in-river fishing and the massive disappearance of sockeye. However, the independent advisors literally defined the new Aboriginal fishery as “a special problem” that weakened DFO enforcement capacity and required immediate measures to avoid a similar crisis in the near future (Pearse and Larkin, 1992: 6). According to the Pearse and Larkin report, the enforcement

arrangements under the new Agreements were unclear and the personnel and resources were not adequate. As a result, “the summer of 1992 was not so much a crisis in resource management as a crisis of policy” (Pearse and Larkin, 1992: 29); in other words, a badly implemented fishery strategy. Drs. Pearse and Larkin identified a series of lessons to be learned from the sockeye crisis as a way “to regain confidence” in the fisheries management (p. 30) and to avoid a “general impression of disarray and abuse in the fishery” (p. 32).

6. **DFO responds to the crisis externally framed;** in this case, as an AFS enforcement problem. Accordingly, government measures were focused on increasing efforts to enforce and control the implementation of the AFS, providing certainty to user groups regarding the legal status of AFS, and avoiding arrangements and decision made at the eleventh hour. The Action Plan and the Fraser and Skeena River Management plans, for instance, significantly increased resources for enforcement during the 1993 salmon fishing season to ensure that DFO met its responsibilities for proper conservation and fair allocation of salmon resources (DFO, 1993a). Similarly, the 1993 bilateral agreements DFO-FN were negotiated well before the beginning of the fishing season to provide a better monitoring of the AFS (DFO, 1993b).
7. **Measures adopted by DFO create new conflicts** with and among user groups, despite its goal of providing more certainty and stability to the management of salmon fisheries and the intention of avoiding in the future the same problems that generated the triggering ecological crisis. The new CAN-US PST, the decision of continuing with the pilot sale project despite the provincial court decision, and the plans to ensure better enforcement of the AFS were highly criticized, mostly by non-Aboriginal stakeholders. For instance, they accused the federal government of getting nothing positive out of the new PST (The Globe and Mail, 06/25/93), criticized DFO for hiding behind the claim that the allocation of salmon to Aboriginal fishermen was somehow a court ordered obligation, and argued that were no longer basis or arguments to suggest that there was an Aboriginal right to sale fish (The Globe and Mail, 07/10/93).

8. A **positive ecological event** (i.e., ‘1993 record sockeye salmon run’) helps to reduce criticisms against DFO and conflicts between stakeholders. Amid the record salmon run of 1993, the Director of DFO Pacific region Aboriginal Fisheries branch said to the media in relation to the dire predictions of the opponents of the AFS: “No ecological collapses, no missing fish, not out of control” (The Globe and Mail, 10/28/93). DFO considered the problem to be solved and government attention was thus diverted to a different issue; viz. a price dispute and a glut of salmon on the market that led the major salmon processors to stop buying sockeye and pink salmon.

### **Attention cycle 1994-1998**

The 1994 fishing season initiated with optimistic expectations for the spawning escapement to many of the major Fraser River tributaries. An early forecast led to a provisional estimate of about 30 million fish, which was later adjusted downward to 19 million. Even so, the 1994 sockeye run was expected to be one of the largest in history. However, in late September and early October 1994, a initial **discrepancy of an estimated 1.3 million Fraser River sockeye salmon** and a further **shortfall of about 2 million sockeye in the Late run**, including the famous Adams River runs, were respectively discovered. A myriad of **claims and counter claims** erupted, blaming illegal fishing, bad management, out-dated technology and environmental disaster for the ‘missing fish’ and poor escapement. This contributed directly to a “**growing lack of confidence**” in DFO management system among user groups and the public, and a widespread feeling that DFO was no longer seriously prepared to enforce its own rules (FRSPRB, 1995: 58; The Vancouver Sun, 10/07/94 and 11/02/94). The perceived credibility of the Department was seriously challenged, and many observers characterized the fishery as an “anarchy” (FRSPRB, 1995; The Vancouver Sun, 11/17/94).

As immediate response, DFO cancelled aboriginal and recreational sockeye fisheries in the Adam River, and the Minister of Fisheries and Oceans, Brian Tobin, established four technical working groups to investigate aspects of this situation. Facing accusations of lack of credibility and independence as the four panel members previously had working relationships with DFO, a week later Liberal Minister Tobin appointed the **Fraser River Sockeye Public Review Board [FRSPRB]**, headed by onetime Conservative fisheries

minister John Fraser. His appointment was a means to calm fears and rebuild shaky confidence in fishery management. Minister Tobin asked the FRSPRB to solve “a disturbing and puzzling mystery” which surrounded the dramatic disappearance of several millions of sockeye salmon that normally would have migrated to spawning areas in the Fraser River watershed.

The FRSPRB undertook a number of technical reviews and DFO’s system of management, monitoring, surveillance and enforcement. Utilizing an open process that allowed the fullest possible access to Board members, more than 3000 calls were received during the period of the inquiry, over 130 formal submissions were received, and 10 days of public meetings were held throughout the province of BC. The FRSPRB had three main objectives: 1) to identify the reasons for the discrepancies in the expected and actual number of sockeye salmon arriving on the spawning grounds; 2) to evaluate the accuracy of the methodology for estimating run sizes and sockeye escapement in the FR; 3) to make recommendations on how any deficiencies could be corrected, beginning in 1995.

The essence of the Board’s findings was summarized in the Executive Summary of its report: “The message is simple: if something like the 1994 situation happens again, the door to disaster will be wide open. According to what the Board found, one more 12 hour opening could have virtually eliminated the Late run of sockeye in the Adams River. Such an occurrence would have devastating consequences for the Pacific fishery, delaying the stock rebuilding efforts by years and bringing dire economic consequences to the province. The Board believes that the **solution** to this problem lies in **fixing the system**” (FRSPRB, 1995: xii).

According to the investigation, the disaster scenario had its roots in the **1992/93 DFO Pacific Region reorganization**: “Cutbacks and budget reductions were made to the extent that DFO was left in charge without the clear lines of the accountability or necessary tools to enforce its regulation with any credibility” (FRSPRB, 1995: xii). The combination of budget cuts and restructuring in DFO created a situation in which the ability to manage the entire spectrum of DFO responsibilities was strained beyond capacity. Due to reductions in federal fisheries budgets, portions of the West Coast were unpatrolled and salmon runs to many spawning streams were not evaluated in 1994.

Critical data about salmon habitat and the activities of the commercial fleet, which is used by DFO headquarters for management planning from one year to the next, was no longer collected. According to the Board, this led to “a virtual **loss of control**” in areas ranging from catch estimation to regulatory enforcement, weak lines of communication, and confusion over accountability that together contributed to the 1994 dilemma (FRSPRB, 1995: 33).

The Board identified other three events that generated this situation. First, the **Aboriginal Fishery Strategy (AFS)** was not working as intended: once again, there was confusion as to who was in charge, obviating effective enforcement. Growing **discontent** with the administration of the Aboriginal fisheries, among both Natives and non-Natives, resulted in “increasing **attitudinal anarchy**” in marine and in-river areas during 1994 (FRSPRB, 1995: 58). Second, between January and July 1994 the negotiations under the **CAN-US Pacific Salmon Treaty (PST) failed** and the harvesting of the Fraser stock could not proceed under a united international plan. On May, ending a series of fruitless meetings with U.S. officials in Washington D.C., Mr. Tobin said in an interview: “We don't have any option but to plan a unilateral action” (The Vancouver Sun, 05/27/94). After the MFO announced on July that Canada was withdrawing from the PST, the government made a policy decision to pursue an aggressive fishing strategy that contributed to a grab-all attitude in the Canadian commercial fleet, and a corresponding removal of any moral responsibility for conservation on the US side. The failure of international negotiators to achieve a Canada-U.S. salmon accord in 1994 set the stage for the “12 hours from disaster” scenario (FRSPRB, 1995: xiii). Third, there were critical **weather disturbances** that caused sockeye to move further north into Alaskan waters. During the Early Stuart and Early Summer migrations, near record-high ocean surface temperatures were recorded in the Fraser canyon, approaching the lethal range for sockeye (>21.5°C).

The FRSPRB presented a case for adherence to a **risk aversion management system**, given the uncertainties inherent to the various estimation techniques. More specifically, the Board's report released in March 1995 included 35 recommendations covering a broad range of issues: Management strategy; management process; enforcement; AFS; watershed management; and user groups. The Board also recommended the creation of

an independent **Pacific Fisheries Conservation Council** (PFCC) to act as a public watchdog for the fishery, to report to the Ministers and the public, with a particular interest in the health of the fish and their habitats. The PFCC was established three years later, in September 1998, as an independent body with no vested interest except the health of the fish and their habitats.

The FRSPRB report concluded that evidence indicated a general **breakdown of enforcement** occurred during 1994 leading to increased unreliability in catch estimates. In conjunction with **uncertainty** regarding in-river catch levels and en-route mortality, the estimates were too prone to **errors** to be useful for this purpose. However, the Board recognized that no one, including the authorities, the experts and the Board itself, knew precisely what happened or exactly how the sockeye crisis of 1994 happened.

In response to the FRSPRB findings and recommendations, in March 1995, MFO Tobin announced a **5-point Action Plan** for the Pacific salmon fishery. Details of the AP included: 1) a more conservative approach to management, 2) increased enforcement; 3) better integration of science and management priorities; 4) a tough stance on the conditions of agreements under the AFS, particularly with respect to 1995 pilot sales; 5) necessary measures to build a fishery based on recommendations from industry fleet capacity. As part of a risk-averse management approach, and following the FRSPRB's recommendation regarding the creation of a consultative forum addressing issues such as overcapitalization and allocation to the competing sectors, the MFO also announced steps to establish a series of multi-stakeholder discussions.

The **Pacific Policy Round Table** (PPRT) was thus created to develop a consensus position within the commercial fishing industry, which was intended to be used to achieve a significant reduction in fleet harvesting capacity. The PPRT was expected to make specific recommendations on commercial fisheries management reforms, harvesting strategies and institutional changes that were needed in the commercial fishery to ensure conservation and sustainable resource use. The PPRT included representatives from the commercial, aboriginal, and recreational sectors, union members, coastal communities, DFO, and the government of British Columbia. As one of the PPRT members expressed to the media, “our job is to try to find a way so that **dislocation** [viz. fleet restructuration], which has to occur as a result of government decision, occurs in a

way that minimizes damage to businesses and people and finds an honorable way out” (The Vancouver Sun, 09/28/95).

On Dec. 14<sup>th</sup> 1995, the Pacific Policy Round Table presented its report on the renewal of the commercial Pacific salmon fishery. The PPRT considered that reducing the size of the commercial fleet was not in and by itself sufficient to renew the commercial sector and fulfill the conservation, economic viability and partnership objectives set by the MFO. Solutions to the problem of salmon fishery would have required fundamental changes in all aspects of the fishery management. The PPRT found the following issues affecting fisheries management: risk of overfishing due to large fleets difficult to control; limits to management flexibility and enforcement difficulties; commercial salmon fleet losing money and concerns about their future economic viability; and complex fishing plans that could not be sustained in a context of fiscal restraint. In this last regard, the Roundtable expressed concerns about the potential impact of DFO plans respecting expenditure reduction on the Department’s ability to manage the resource. The PPRT made a series of recommendations grouped under the following categories: Intersectoral allocations; Management options; Government financial support and transition assistance to facilitate fleet restructuring; Commercial licence fees; Partnership agreements between DFO and the commercial fishing industry; Habitat management; Salmon enhancement and production.

To resolve allocation issues identified by the PPRT and review different options, **five consultation processes** were conducted between January 1996 and March 1998. The areas studied included allocation within the commercial sector (intrasectoral), allocation between the commercial and recreational sectors (intersectoral), and a review of the Aboriginal Pilot Sales Program. The following consultation processes took place: Dr. Art May report on Intersectoral Allocation (Jan/96 to Dec/96) followed by Mr. Samuel Toy report on the implementation of Dr. May’s recommendations (Oct/97 to Mar/98); Mr. James Matkin report on AFS Pilot Sales Program (Dec/96 to Feb/97); and two reports by Mr. Stephen Kelleher on commercial Allocation (Mar/96 to June/97, and Oct/97 to Apr/98). Representatives from all user groups called for greater predictability in allocation decisions and they all seemed to agree that conservation and sustainability were paramount. However, they were unable to reach consensus on sharing of the

resource. All these independent advisors appointed by DFO have commented on the difficulties of reaching consensus on allocation issues among and within user groups.

In response to the Pacific Policy Roundtable, on March 1996, B. Tobin's successor as MFO, Fred Mifflin, announced a comprehensive strategy aimed to revitalize the West Coast commercial salmon fishery, conserve salmon stocks, and ensure that they were harvested in ways that sustained their use by future generations: the Pacific Salmon Revitalization Strategy (commonly known as **the Mifflin Plan**). The goal was to provide for the long-term economic viability and competitiveness of the commercial salmon industry, enabling it to provide reasonable incomes to the people who relied on it for their livelihood. The Plan was intended to reflect DFO's more conservative risk-averse management that stipulated that conservation was the number-one priority so adequate numbers of returning salmon reach their spawning grounds each year. The PPRT recommended the commercial fleet to be reduced, starting in 1996, by at least 25% and up to 50%.

In the press release announcing the Plan, DFO stated that the strategy was necessary for the following principal reasons: a change in ocean conditions which led to lower salmon productivity; short, crowded openings that increased resource risks; rising costs for fishing fleet operations; and lower world prices for salmon. These factors combined to affect adversely the economic viability of the commercial Pacific salmon fleet during the 1995 and 1996 seasons. For reasons that could not be attributed to overfishing but to natural ecological causes –such warmer ocean temperature and predatory mackerel fish–, in 1995 the salmon runs came in much lower numbers than anticipated and the harvest fell 42% from recent averages, causing a 65% decline in income for the salmon fleet. In August 1995, when only one-third of the fish expected to return to the river showed up, MFO Tobin announced the fishing closure indefinitely on Fraser River sockeye, the most lucrative salmon runs in British Columbia. Pre-season estimates called for over 10.7 million sockeye to head to the Fraser River from the ocean but it was later downgraded to 3.3 million. “With this kind of numbers and with Fraser sockeye being the backbone of the industry, it's a pretty devastating scenario for fishermen” said a director of the Pacific Gillnetters Association to the press (the Vancouver Sun, 08/10/95). Similar concerns were expressed by the representative of the Fishing Vessel Owners' Association and the

Sto:Lo Fisheries Authority in the Fraser Valley (The Vancouver Sun, 08/08/95). Mr. Tobin anticipated that 1996 was going to be also “a bad year” because it was the low year in the stock’s 4-year cycle, and that the Fraser River sockeye run was not going to be open to commercial fishing (The Vancouver Sun, 08/14/95 and 12/07/95). Salmon were only expected to return to historic levels in 1997.

The **two consecutive poor salmon seasons 1995 and 1996** showed incomes and profits fell to record lows. The 1995 landed value, approximately \$80 million, was less than 40% of the average annual revenues over the 1991 to 1994 period, and dropped to its lowest level since the fishery was limited in 1969. The landed value in 1995 was about half the landed value in 1991 which was indeed a very poor year. Catches in 1996 were around a third of what they had been in 1990. In essence, the Mifflin Plan aimed to conserve stocks by adopting a risk-averse management approach and to improve manageability of a smaller fleet. As a result of the Plan, the 1996 fishing season opened with 30% fewer boats on the water. At that time, DFO considered that “the strategy is working [...] Conservation and sustainability goals are being met” (DFO, 1997a: 2). In addition, DFO announced that the smaller fleet was able to harvest the available catch at a lower cost, resulting in an increase of \$21 million in net income.

Despite these positive results, the comprehensive nature of the changes envisioned by the Plan, together with the pace of their implementation, led many to react negatively and sparked **vociferous criticism** from day one (The Vancouver Sun, 04/06/96, 04/10/96, 04/13/96, 04/29/96). Some claimed it was going to devastate the isolated fishing communities along the B.C. coastline that were already struggling to survive the loss of jobs in other related industries (e.g., people working at boatyards). Others claimed the Plan was imposed without consensus, even though there appeared to be little agreement among the multitude of interests and advisory groups, and without assessing its impacts on the environment and the communities. Animosity was not only directed at DFO, however. Commercial, sports, aboriginal, fish farmers, the provincial government, fish processors and gear types from within the industry were all publicly **attacking ‘the other guy’**. Environmental issues were also raised: it was pointed out that the Mifflin Plan should have included funds for habitat restoration and enhancement, and that it was leaving large numbers of vessels in the fishery with no limitations to their ability to

upgrade technology and become more efficient, creating incentives to exploit stocks to the maximum allowable limit.

Representatives of rural communities, Native interests, fishermen's union representatives, environmentalists and even the provincial government advocated program changes. By the end of April, a broad 45-person contingent made of fishers, environmentalists and politicians from B.C. flocked to Parliament Hill to pressure the federal government to alter its plans for cutting the West Coast salmon fleet. It was the latest step in an effort to dissuade MFO Mifflin from his plan for vast changes to the commercial fishing industry. BC Premier Glen Clark communicated his concerns to Prime Minister Jean Chretien at the First Ministers' Conference held in May 1996. Mr. Clark criticized the Mifflin Plan and said he wanted the province to take over responsibility for managing the fishery, including control of fishery conservation, salmon habitat preservation and a plan of fleet reduction. Interviewed by the press, Clark considered that MFO Mifflin was not the right man for the job: "he clearly has misjudged the fishery issue in British Columbia and is not treating it with sufficient urgency and concern" (The Vancouver Sun, 04/17/96). Mr. Mifflin ridiculed Clark's plan, implying that it was an election stunt, an electioneering proposal.

As the "**salmon war**" between BC and Ottawa escalated, in September 1996 the provincial and federal governments signed a Memorandum of Understanding on fisheries issues and formed a **Federal-Provincial Tripartite Review Panel** to analyze the impacts of the Plan and make recommendations for determining appropriate adjustment measures. The Tripartite Panel was made of an independent member, one member appointed by the provincial government and another member appointed by the federal government. The Panel began a series of community-based, coast-wide consultations which took it to 22 communities and allowed it to meet with more than 1,700 people over a period of 10 weeks. In its coastal travels, the Panel noted a series of troubling messages, for instance: while many speakers, from a cross-section of fishing and interest groups, said the Mifflin Plan was the main cause of the fleet's current financial instability, others told the Panel that the industry had been in a decline long before the Plan was introduced, and endorsed the main components of the salmon fleet revitalization program. The Panel soon learned that such a complex and technical restructuring plan was poorly understood by many

fishers and the general public alike. Compounding this paucity of communications was a widely-held perception that many DFO management and policy decisions were made in Ottawa, rather than British Columbia.

The Panel learned that, as a direct result of the Mifflin Plan, fishers who stayed in the business shared net earnings of \$21 million more (as manifested by DFO), but also that it caused job and income losses for many: up to 2,750 crew lost all or part of their income from the fishery, and industry expenditures to suppliers decreased by an estimated \$19.1 million because fewer vessels needed outfitting. This in turn resulted in 145 fewer jobs in the supply sector with an associated wage bill of \$2.9 million. Generally speaking, the impact of selling licences was felt more severely in smaller coastal communities, especially those with large aboriginal populations and already plagued by low per capita incomes. The federal fleet-reduction component was not coupled with an adjustment and transition program for the displaced and for those communities severely impacted. Communities did not feel they were properly consulted about the fleet restructuring plan or that they were being treated as full stakeholders by DFO. Moreover, the Plan was implemented at a time when fishers were vulnerable, as a result of the two disastrous salmon seasons of 1995 and 1996. Others felt that it was partly for these very reasons that action was urgently needed.

After hearing from all interested parties, the Tripartite Panel identified and investigated a series of major themes and produced several recommendations grouped in the following categories: Management and conservation; Community impacts and adjustment needs; Voluntary buyback; Licence stacking; Access to capital; Corporate concentration; Allocation; Single-gear restrictions; Area licensing; Partnerships and improved relations; and Vision and Marketing. The Panel anticipated that the implementation of these new recommendations was not going to be easy as there was a basic **lack of trust** among all the players –i.e., governments, industry, gear types, communities and the many people dependent on B.C.'s salmon fishery. The Panel concluded: “If, as the Panel strongly urges, governments and industry consider and implement the recommendations detailed above, pivotal to any real world success will be a new set of relationships built on trust. A daunting challenge indeed” (Pacific Salmon Revitalization Plan Review Panel [PSRPRP], 1997: 20).

On January 9<sup>th</sup> 1997, MFO Mifflin announced that the Government of Canada was taking **positive action on the recommendations** of the Tripartite Panel reviewing the Pacific Salmon Revitalization Strategy. Mr. Mifflin announced that **funding of \$35.7 million** was going to be provided to support the Tripartite Panel's report. The funding was applied to: i) a habitat restoration/salmon enhancement pilot program, with a federal contribution of \$15 million over three years; ii) facilitate access to credit for troll and gillnet licence holders who need financial assistance to stack licences, with funding of \$5 million; iii) a \$8 million gear payment program to pay fishers for gear now unusable under the single-gear licensing provisions of the plan; iv) a jointly-funded program with the province of B.C. providing early retirement opportunities for fishers, with federal funding totalling \$7.7 million. The MFO called on the BC government to provide matching funds for the habitat restoration program and the early retirement assistance, and took steps to improve consultation between provincial interests and the Department (DFO, 1997b and 1997c).

The Mifflin Plan, modified by the changes outlined above, remained in place during the 1997 fishing season signed by poor salmon runs, low prices and, for the fourth straight year, the collapse of treaty talks with the United States. Mifflin's successor as MFO, David Anderson, considered that the federal policy of reducing the B.C. salmon fleet was a success. "With the number of vessels reduced, the catch is being shared by a smaller number of fishermen. This has improved the economic health of the fleet and raised average earnings per vessel," MFO Anderson said during a speech to a Commons committee reported by the press (The Vancouver Sun, 01/21/98). Based on figures released by DFO, in 1997 the commercial sector still managed to catch about \$100 million worth of salmon, about the same as in 1996. According to Mr. Anderson, the Mifflin plan that spent \$ 80 million in 1996 to buy out boats and reduce the size of the fleet by 30% was one of the big reasons B.C. fishermen weren't hit as hard as they might have been when runs failed to materialize as expected. The average seine catch per boat was worth about \$120,000 in 1997 but had the fleet not been reduced, the average would have been about \$80,000. The average gillnet catch was worth about \$18,000 but would have been around \$12,000 without fleet reduction, according to federal fisheries statistics (The Vancouver Sun, 01/21/98).

The fleet restructuring, initiated by Mifflin and continued by Anderson, was highly criticized and disapproved by commercial fishermen who were affected by such dramatic reduction and salmon prices that in 1997 dropped to one-third of what they were in 1992. However, no new substantial measures affecting fisheries management were announced until 1998 when a new ecological catastrophe, the “**Coho crisis**”, marked a turning point for DFO in the Pacific Region and the commercial salmon fishery in BC (DFO, 1999; Butler 2006). DFO’s **Coho Recovery Plan**, a \$400 million investment, represented an important step towards restructuring the fishery and the transition to a new management approach. The Coho Recovery Plan dealt primarily with the immediate Coho conservation crisis but it was also intended to address a number of fundamental problems, such as: plunging world prices, declining catch rates and over-capacity that made the fleet’s outlook uncertain. The Coho crisis, its causes and consequences for DFO management system are part of an attention cycle not analyzed in this study.

#### **Event Structure Analysis of attention cycle 1994-1998**

Graphic 8.2 below shows the implicational structure of events (i.e., issues and answers) during the attention cycle 1994-98. As in the previous cycle, the chart was generated answering historical causation questions and it was tested for logical inconsistencies using ETHNO.

The chart shows, firstly, how the wicked problem under examination evolved during this attention cycle. As with the previous cycle, the direct cause of a series of interrelated governmental responses is an ecological catastrophe (i.e., **Missing sockeye (crisis)** event). This is itself the consequence of cumulative effects of negative ecological events (**Weather disturbance**), aggressive fishing caused by lack of international cooperation in regulating fisheries (**CAN-US PST breakdown**), enforcement problems created by a badly implemented AFS (**AFS enforcement problems**) and budget cutbacks in DFO (**92/93 DFO reorganization**). The decision to deploy a series of direct interventions (e.g., **Fishing closure, DFO technical groups, FRSPRB**) only after an ecological crisis has exploded is in part explained by the high degree of conflict between stakeholders and the loss of public confidence in DFO capacities that such crisis generated. In relation to the federal austerity programs and cutbacks, for example, the FRSPRB (1995: xii) indicated that the attitudes created by the DFO’s reorganization generated an

“atmosphere of uncertainty and total lack of confidence both within DFO and from the outside.”

Confirming what has been observed in the previous attention cycle, events that produce a great deal of conflict between user groups and/or significantly undermine public confidence in governmental institutions are more likely to receive more attention from the government than those that don't do so. Secondary sources of information show that in August 1994 Fraser River natives (i.e., the Sto:lo fisheries authority) wrote to MFO Tobin warning him of the “alarming discrepancies” between estimates and the actual summer spawning escapements, before the collapse in estimated returns (The Vancouver Sun, 10/17/94 and 11/23/94). That letter urged Minister Tobin to reconsider the advisability of pursuing an aggressive strategy for fishing returning sockeye stocks simply to oppose American interests given the lack of international cooperation under the PST (The Vancouver Sun, 10/17/94). (It is worth noting the FRSPRB identified this situation as a major cause of the “12 hour disaster scenario” that almost led to complete disappearance of the Adam River run). The letter sent by the Sto:lo fisheries authority, however, went unanswered until November 1994, when the ecological disaster already happened. Specific actions were taken only after DFO's attitude raised alarming questions among user groups and the public in general about the government's credibility and capacity to ensure the interests of the salmon and regulate the fishery.

**Figure 8.2. Structure of events 1994-98**



Source: own

Figure 8.2 shows that DFO attention process during the 1994-98 period evolved according to the following sequence of events:

1. The combination of societal and environmental issues creates another ecological **'crisis'** that generates **protests** against DFO and **conflicts** between stakeholders. In this case, there were abundant arguments about who was to blame for one of the worst near-disasters in the history of the salmon fishery: non-native fishers

accused native fishers of poaching, while Aboriginals considered that overly aggressive fishing and faulty fish estimates caused the massive salmon disappearance (The Vancouver Sun, 11/23/94).

2. The government establishes **internal procedures and/or structures** (*DFO technical groups* event in Graphic 9.2) to investigate the ecological crisis, and uses instruments at hand (*Fishing closure*) to try to find a short-term solution.
3. Routinized measures and internal investigative processes, however, are not enough to deal with the crisis. **Protests and conflicts** escalate, and the **public confidence** in DFO's regulatory capacity is severely questioned. According to the FRSPRB, one of the key aspects affecting public confidence was the lack of accuracy of a variety of estimators that were critical in formulating fishery management decisions in the Fraser River. According to the Board, the accuracy of estimators was eroded as a result of changes in migration patterns, unusual environmental conditions, increased complexity of the fishery, new methods used to collect catch data, and declining numbers of scientific, management and enforcement personnel available to carry out management tasks. These problems created a growing **lack of confidence** in DFO's fishery management system, which has in turn led to a breakdown in **compliance** and further **loss of accuracy** in the estimates (FRSPRB, 1995).
4. DFO establishes **external procedures and/or structures** to investigate the crisis (*FRSPRB* event). The fact that Mr. Tobin, from the Liberal party, appointed a former Conservative MFO as the head of the FRSPRB can be seen as a way to give credibility to the external Board, after the internal DFO investigation was criticized for not having enough independency from the Department. Thus, **investigative capacities** are assigned to an independent body that implements a consultative process to better understand the causes of the crisis. The appointment of the FRSPRB also shows DFO's concerns about the massive disappearance of fish and its firm decision to attend to this issue. In announcing the appointment of the FRSPRB Mr. Tobin said to the press that "[t]his issue is serious, it ought to be taken seriously [...] There's something fundamentally wrong and we need to find out what is fundamentally wrong" (The Vancouver Sun, 10/04/94).

5. The **external investigative structure frames the triggering sockeye crisis** and makes a series of recommendations. The FRSPRB defined the sockeye disaster as a problem caused by optimistic estimates of the run size, which fostered risky management decisions by DFO, allowing far too much fishing and nearly decimating several runs. According to the Board, blame was found everywhere but “**little attention was paid to the core problem: the system had become dysfunctional**” (FRSPRB, 1995: xii). The independent investigation showed that DFO’s fishery management system was not able to cope with ongoing changes to both the traditional commercial and aboriginal components of the fishery, and it was pushed beyond its capacity. Accordingly, the Board urged DFO to establish a risk-averse management system in which the overriding goal should have been to ensure that an ample number of salmon return to spawn each year (i.e., conservation of the resource).
6. **DFO responds to the crisis externally framed**; in this case, a risky management system that created enforcement problems and lack of confidence in DFO’s capacity to regulate fishery and make salmon stocks economically and ecologically sustainable. The FRSPRB investigation made the case for a risk-averse management system to correct and prevent these issues in the future, and the federal government implemented a series of measures to address this recommendation (i.e., *5-point action plan*, *PPRT* and *Mifflin Plan* in Graph 9.2) and to improve consultative process that would increase consensus among key stakeholder (i.e., *PFCC* and *5 consultative procs*). Announcing the 5-point Action Plan that provided the foundations of a risk-averse fishing strategy, Minister Tobin said that “rather than enhancing our ability to manage closer to the edges – by increasing exponentially the staff and resources of the department– we must instead pull back from the edge” (DFO, 1995: 1). By adopting such measures, DFO needed to leave no uncertainty as to its commitment to re-establish a credible regulatory compliance level and penalize all those who abused the law in order to increase public confidence in the Department’s management capacities and regulatory power. Unless DFO was seen to have an effective commitment to enforcement, there was not going to be compliance (FRSPRB, 1995).

7. The combination of a contested consultative process (PPRT), a highly controversial strategy (Mifflin Plan) to address the recommendations of the independent investigation, and negative ecological events (disastrous 1995 and 1996 fishing seasons), far from reducing tensions between stakeholders generated **major conflicts and protests against DFO**, viz.: *Conflicts b/stakeholders (MP)*, *Criticisms to DFO*, and *BC-Ottawa salmon war* in Graphic 8.2. The PPRT, for instance, was criticized for being seriously flawed in several respects, among them: the lack of a neutral person in the role of the Chair for the process; dependent coastal fishing communities were excluded from the process; and the process launched by DFO for developing a fleet rationalization plan was both undemocratic and unethical (PPRT, 1995). Similarly, representatives of Aboriginal fishermen considered that the results of the Roundtable process had a detrimental impact on native participation in the commercial fishery in terms of jobs, and that the MFO failed to provide for adequate representation of BC First Nations while the commercial and recreational fisheries were very well represented (PPRT, 1995). An evaluation study of DFO's response to the FRSPRB found that "the PPRT have created in the end **more conflict between DFO and user groups rather than less**. It was a reasonable well designed consultative process for the commercial industry but many industry participants now feel that **DFO ignored the consensus** they reached" (EB Experts Inc, 1996: 21). The Mifflin Plan was indeed not very well received by most PPRT participants who felt that the key ingredients of the consensus reached have been lost in DFO's fleet restructuring plan (EB Experts Inc, 1996). As a consequence, the Mifflin Plan, rather than building better relationships, as intended, **exacerbated bad feelings** in a fishing industry struggling for its very survival, and it increased open mistrust and disdain towards DFO fisheries officers and managers.
8. To reduce conflict, the government **assigned investigative capacities** to another independent consultative body (i.e., Fed-Prov. Tripartite Panel) that was focused on providing recommendations to improve the controversial fleet restructuring program. Acknowledging that the context for the fleet renewal was characterized

by a lack of confidence in the state of the partnership between the commercial sector and DFO (PPRT, 1995), the Tripartite Panel proposed a set of recommendations pointed towards improving partnerships and relations through consultative processes. Its goal was to ensure that local and community interests were part of the development and implementation of fishery management. More specifically, the Panel considered that in order to support the positive partnership initiatives already initiated by DFO, “**particular attention must be paid to reducing conflict** between, and improving working relationships with, the different stakeholders under DFO's statutory responsibility” (PSRPRP, 1997: 18).

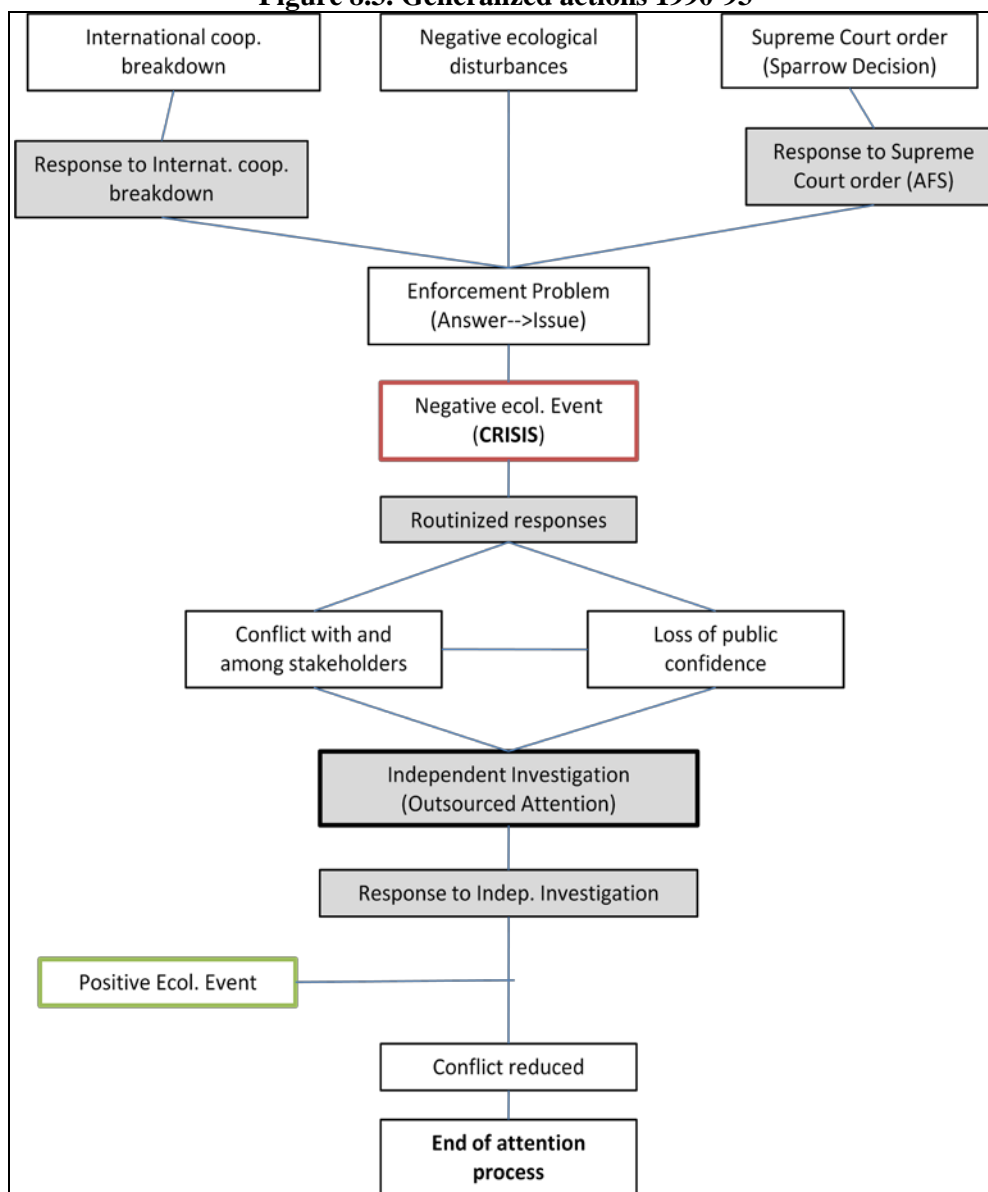
9. **DFO's priorities changed**, from solving the ecological sockeye crisis to reducing the negative effects of a previous ‘solution’ to deal with such problem. Thus, on top of the \$37.5 million allocated to take positive action on the recommendations of the Tripartite Panel regarding habitat restoration, access to credit, gear payment program, and early retirement, DFO was committed to ensuring continued integrity in consultation processes and establishing a new ministerial advisory structure (i.e., the PFCC), later created under MFO Anderson's mandate. The creation of the PFCC was seen as “an essential condition for building **public confidence** in the fairness, rationality and effectiveness of fisheries resource conservation policies, priorities, strategies and activities” (FRSPRB, 1995: xv).
10. In the face of another negative ecological event (‘Poor 97 season’ in Graphic 8.2), conflicts and discrepancies between DFO and stakeholders around the modified governmental measure –i.e., the Mifflin Plan– continue (see events ‘Criticisms to MP’ versus ‘DFO feeling successful’).
11. A **negative ecological event** (i.e., *Coho crisis*) makes the DFO's attention shift to another (wicked) problem, triggering a new series of responses (*Coho Recovery Plan*).

### **Comparison of attention cycles 1990-93 and 1994-98**

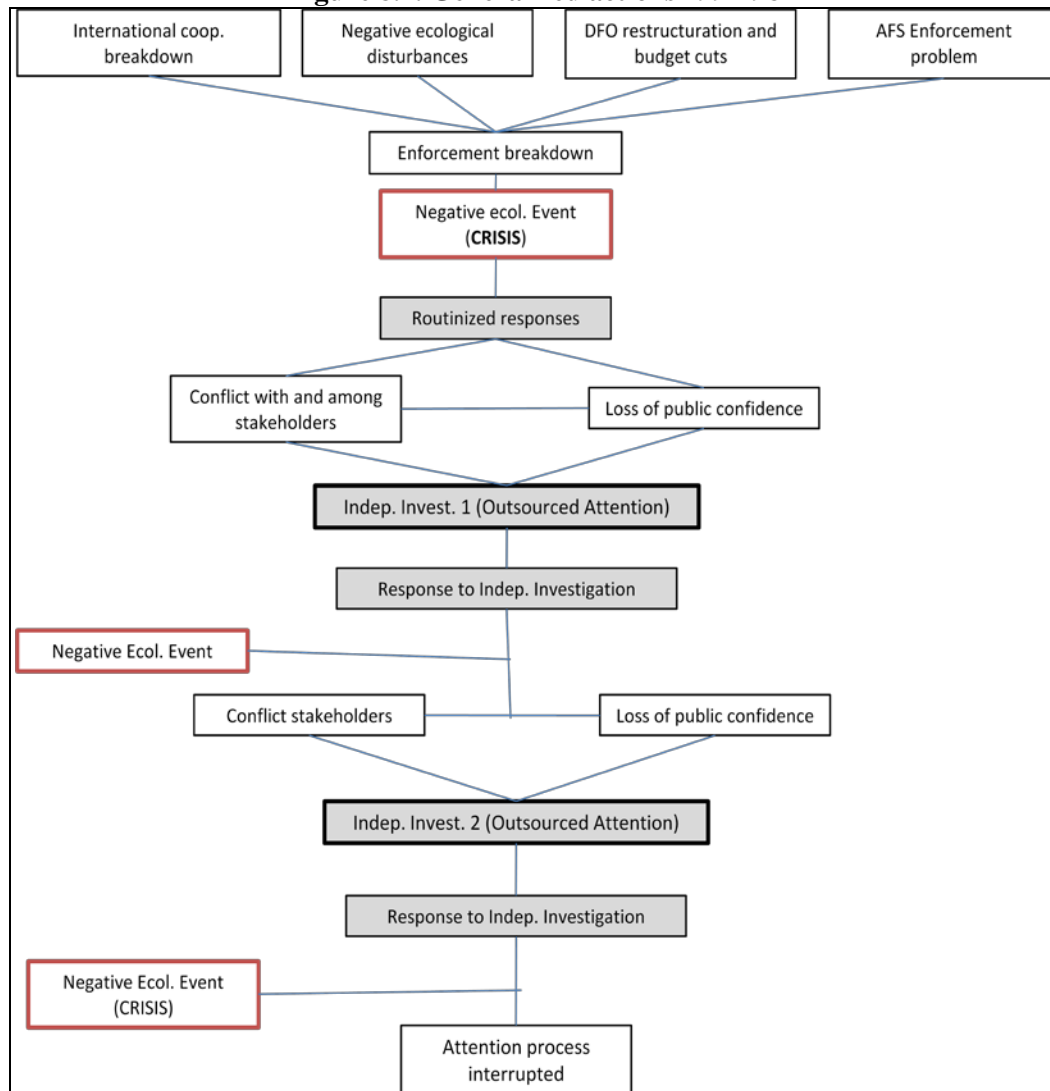
In order to discern the government attention process on the sustainability of wild Pacific salmon in BC and the attention patterns and policy outcomes that such process creates, I use ETHNO's generalizing function. It allows a researcher to formulate a model of actions that refers to more abstract kind of actions than the concrete actions showed in

Graphics 8.1 and 8.2. The charts below show in each attention cycle concrete actions that instantiate generalized actions if the occurrence of a concrete action is reason to say that a generalized action occurred as well (Heise, 2012). The resulting generalized models are compared for purposes of identifying regularities and differences across cycles that will contribute to the analytical generalization of findings. Comparing attention cycles is important in this regard because, as other organizational patterns, government attention patterns on a wicked problem are not created or invented; they are discovered from empirical observation.

**Figure 8.3. Generalized actions 1990-93**



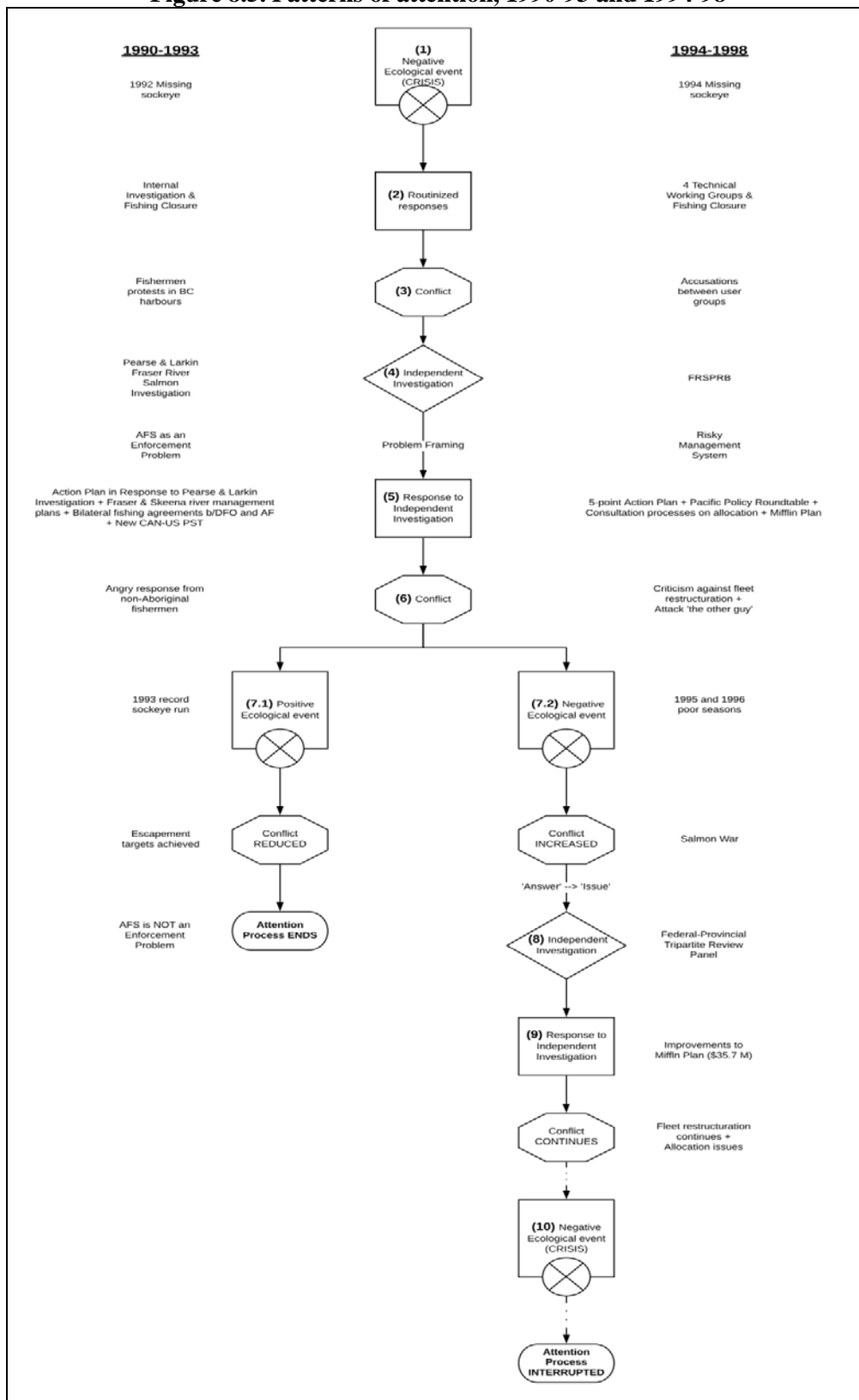
Source: own

**Figure 8.4. Generalized actions 1994-98**

Source: own

Reaching this point, it is worth recalling the definition of attention pattern proposed for this study in Chapter 8: it is as a reliable sample of actions, tendencies and observable characteristics of an institution –i.e., DFO–, which helps discern a coherent attention process based on the intended interrelationships of its component parts. Based on the understanding of attention as a non-mechanical process (Cohen et al., 1972, Kingdon, 1984, Dutton et al., 2001), the comparison of the two cycles of events shows the following attention pattern of DFO on issues affecting the sustainability of wild Pacific salmon:

Figure 8.5. Patterns of attention, 1990-93 and 1994-98



Source: own

What follows is a narrative explanation of the attention pattern shown in Graphic 8.5. The bold numbers below correspond to the stages (bold numbers) included in the graphic.

**(1)** The two cycles show that the attention process on a wicked problem initiates in a similar way with a crisis generated by recurrent external factors or conditions. In both cases, the stimulus triggering the attention process is an ecological event that is intense and big in size given the amount of missing salmon in the 1992 and 1994 fishing seasons. The triggering crisis is itself the consequence of a series of events of different nature whose effects, not initially addressed, accumulate over time. Such indirect causes fall beyond the direct control of the Department as they are natural environmental changes – i.e., negative weather disturbances–, and/or decisions imposed externally by the judicial branch that the government is obliged to address –i.e., the Sparrow Decision–, or decided by other, more influential spheres of government –i.e., budget cuts and lack of international cooperation between CAN and US. These events that are not under the immediate control of DFO’s decision makers have consequences on the Department’s daily operation, generating an underlying problem that eventually incubates the conditions for a crisis in both cycles, namely: the inability to enforce its own rules. For instance, in relation to the Sparrow Decision, the FRSPRB report indicates that the Supreme Court order weakened the regulatory powers of enforcement officers thus contributing to the unregulated and uncontrolled in-river fishery that was later indicated as the main cause of the missing sockeye crisis of 1992 (Pearse and Larkin, 1992).

**(2)** Once the crisis is evident, DFO responds using tools at hand, such as appointing internal investigations and establishing fishing closures. Thus, DFO initially “routinizes” solutions using bureaucratic structures as if there was an absence of conflict over means (causation) and ends (preferences) (Thompson and Tuden, 1959). Given the impossibility of improving habitats on rivers or conditions at sea, which have a high impact on salmon’s life cycle, DFO has to rely on management tools that allow it to change the conditions of fishing and the impact of fisheries on salmon stocks.

**(3)** Routinized measures have not a significant impact on many of the factors that affect fish populations, as observed by an experienced former DFO member interviewed for this study. Thus, the crisis persists (or increases) creating conflicts –i.e., tensions between

stakeholders and protest of stakeholders against DFO— that affect the public confidence on its regulatory and managerial capacities.

(4) In order to reduce tensions and protests, and regain public confidence, the government assigns investigative functions to an external consultative body: Pearse and Larkin investigation in 1992, and the Fraser River Sockeye Public Review Board (FRSPRB) in 1994. Similar to executive attention at individual level, these external structures have the role of managing a great deal of information collected from many sources in a short period of time (less than 3 months), block potentially distracting information from the focus of attention (i.e., the triggering crisis), and frame the problem in terms of causes and solutions that have to be taken to reduce its effects and prevent it to happen again. The appointment of independent investigations can be seen as an *outsourcing of executive attention capacities* that helps DFO to define and control a course of action by adopting recommended solutions and successfully monitoring actions that facilitate the attainment of resource conservation and utilization goals.

(5) The federal government adopts the recommendations made by the external body depending on how the crisis was framed. In the first attention cycle, the missing sockeye event was framed as an *enforcement problem* of the Aboriginal Fishery Strategy (AFS). The solutions adopted by DFO in 1993 were focused on improving consultation and negotiation processes with Aboriginal communities, building an enforceable management system to reduce the levels of uncertainty, confusion and controversy regarding the AFS, doubling the enforcement efforts during the salmon fishing season, and improving the methodology for estimating salmon runs.

In the second attention cycle, the FRSPRB defined the ecological crisis mainly as *the consequence of a risky management system* that needed to be fixed. The solutions that DFO implemented (e.g., the 5-point Action Plan for the 1995 Pacific Salmon Fishery, the Pacific Policy Round Table, and the Mifflin Plan) were part of a more conservative, risk-averse strategy recommended by the FRSPRB, which was directed towards reducing the fleet harvesting capacity. As a consequence, while in 1993 only \$7 million were allocated to buy out commercial licences, in 1996 the amount to reduce the size of the fleet was \$80 million. Using budget distribution as a proxy for attention allocation, it is possible to observe how the government attention on fleet restructuration issues has increased

notoriously in only three years as a consequence of how the triggering ecological crises were framed by the independent investigative bodies, rather than due to the underlying causes of such crises that, as it is shown above, are very similar in the way they were incubated.

**(6)** Given the diversity of stakeholders' interests, adopted solutions create new conflicts. Crosbie's Action Plan prompted an angry response from non-native commercial fishermen who demanded the government to cancel the commercial salmon-sale agreements with Aboriginal fishermen. Similarly, the Mifflin Plan was highly criticized by user groups and coastal communities due to its economic, social and environmental consequences, and a variety of stakeholders advocated program changes.

**(7.1)** In the presence of a positive ecological event (i.e., record 1993 return) following the implementation of solutions recommended by the external attention body, tensions between stakeholders and protests against DFO decrease and the attention process ends. The controversial AFS and pilot sale projects continued and, although some degree of conflict remained around the Aboriginal rights to fish, in an atmosphere of abundance they were no longer pointed as the "special problem" causing the negative ecological events of 1994 to 1997. As the FRSPRB (1995: 58) indeed indicated, "during 1994, enforcement appears to have been given a low priority."

**(7.2)** In the presence of another negative ecological event (i.e., disastrous 1995 and 1996 seasons), adopted *answers* turn into *issues* (i.e., Mifflin Plan) and conflicts increase substantially (i.e., 'Salmon war'). Due to a repetition of the stimulus, a negative ecological event makes DFO attention to be sustained over a longer period of time.

**(8)** As the effects of the negative ecological event persist, DFO initially routinized solutions again, using traditional management tools at hand (i.e. fishing closures in 1995 and 1996). However, the escalating conflict with stakeholders and other level of government compels the government to assign investigative functions to another external consultative body (the Federal-Provincial Tripartite Review Panel) as a way to reduce tensions and protests, legitimize actions and regain public confidence. This external structure is, however, not required to focus on the ecological crisis –the "disturbing and puzzling mystery" that triggered a series of interrelated responses– but on the societal effects of an answer that turned into an issue (i.e., the Mifflin Plan).

(9) The federal government adopts recommendations made by the external body (i.e., additional \$37.5 million funding), but it decides to continue the controversial measure. In an atmosphere of scarcity (i.e., poor 1997 season), tensions and protests against DFO's decision persist.

(10) A new critical event (i.e., the 1998 Coho crisis) interrupts the attention process. DFO's attention is diverted to a new problem that requires a different set of responses and a new fishery management system (i.e., the \$400 million Coho Recovery Plan). Previous conflicts are not resolved and persist over time as the commercial fleet rationalization continues under the new system, and the effects of such restructuring were still a very important issue for a variety of stakeholders. Inter- and intra-sectoral allocation issues, for instance, continued to be the subject of debate for a number of years as there was a continuous need for allocation agreements among the commercial, aboriginal, and recreational users, among the commercial fleets using different gear, and among individuals within each fleet.

## **Discussion**

Mainstream theories of attention presented in Chapter 2 assume that government attention is mainly motivated by the goal of resolving a problem at hand. The analysis presented here suggests that when it comes to wicked problems, which cannot be definitely solved, the attention process of public organizations is motivated by disputes between stakeholders and protests against DFO that severely question its capacity to fulfill its mandate.

To better understand this conflict-driven attention process, it is worth recalling the definition of the Fraser River watershed as a policy subsystem: it is characterized by a substantive (wicked) issue, a geographic scope and a set of stakeholders from different affiliations within and outside different levels of government (Sabatier and Jenkins-Smith, 1999; Weible, 2005; Cairney and Weible, 2015). In the Fraser River subsystem there is a broad spectrum of interests involved in the sustainability of Pacific salmon: a federal agency regulating fisheries, provincial agencies overseeing the sale of fish, Aboriginal tribes managing salmon, other resource users and businesses with economic interests, citizen groups with environmental interests, etc. All these stakeholders have permanent interests in the Fraser River watershed, even though their access and influence

may fluctuate over time, as it has been the case for Aboriginal fisheries after the Sparrow Decision. The members of the policy subsystem understand the policies being made and implemented in the Fraser, and spend considerable time and effort working to change those policies to suit their own needs. Although the members of the subsystem may reach consensus on some matters (e.g., conservation as a goal), they are often opponents on others. Conflicts among them –not always visible in the mass media, nor are their issues often contested in elections– is what keeps government attention focused on the subsystem, which would be otherwise diverted to other less complicated scientific problems or more immediately salient issues for the media and the public (Downs, 1972; Lee, 1993). In a nutshell, the more intense and repetitive a social conflict in the policy subsystem, the more it affects public confidence, and the longer the attention of the government on a particular issue will be sustained.

The two attention cycles shows that the degree of conflict related to an ecological crisis depends in part on the expectations of the user groups at the beginning of each season and the whether it is possible or not to fulfill such expectations. When based on the pre-season DFO estimates the expectations of a good fishing season are high (e.g., in 1992 and 1994) but the in-season stocks are low, conflicts surrounding a critical negative ecological event (i.e., ‘missing sockeye’) are also high. A key source of conflicts are disagreements about the causes of the crisis: user groups blame each other for the low return –e.g., accusations of poaching or overfishing abound– and criticize DFO’s capacity to ensure compliance of fishery regulations and the accuracy of its estimates. This contributes to the perception that the fisheries are “out of control”, which negatively affects the confidence of the public in the government’s capacity to fulfill its mandate. As in a vicious circle, the erosion of public confidence in DFO’s enforcement capacity reduces stakeholders’ compliance of the Department’s regulations, which in turn generate more uncertainty about catch estimates and disputes among user groups and other stakeholders. The government is thus urged to take action to both reduce conflict and regain public confidence. On the contrary, when the pre-season expectations are low (e.g., in 1995) and the in-season returns confirm those expectations, the degree of conflict over a negative ecological event (e.g., disastrous 1995 season) is also low. In such cases, the urgency of the government to respond decreases despite the negative event in

question have had similar economic consequences than other ecological events (e.g., crisis of 1992 and 1994) but comparatively a lesser degree of conflict and erosion of public confidence.

The fact that stakeholders' conflicts and confidence depend on their expectations leads to consider how the four wickedness dimensions of SPS contribute to creating tensions and controversies among user groups. First, salmon population is notoriously variable among years and is made up of different species and diverse stocks that are highly sensitive to unanticipated environmental changes whose potential impacts make it hard to accurately forecast expected returning runs (PPRT, 1995; May, 1996). As well there are substantial data collection requirements necessary for assessing the health and size of the stocks (May, 1996). In a period of rapidly changing, dynamic conditions in the marine environment, the effects of these changing conditions on production is very uncertain. Thus, user groups' expectations are based on forecasts of salmon returns that are always associated with a level of uncertainty that can make in-season estimates inaccurate. This may result in failure to achieve desired escapement goals, allocations to some user groups that are not met, and harvest rates that are higher than anticipated. These problems are usually not detected until it is too late to take remedial action (FRSPRB, 1995).

Paradoxically, to achieve cooperation and commitment from different user groups on the necessary changes to achieve conservation and sustainable use of the resource, more certainty on long term catch shares is essential as well as the assurance that the expected gains (e.g., higher productivity achieved through fleet rationalization) will not be appropriated by other sectors. User groups call for greater certainty and predictability in salmon allocations and catches but, unfortunately, there are no formal, universally accepted, publicly available policies to deal with the uncertainties surrounding the highly variable salmon production and the challenges of assessing the state of and managing the resource in a sustainable way. As a consequence, tensions and conflicts among stakeholders are always latent and are further heightened in the presence of negative ecological events (May, 1996). Several reports account for the impossibility of building consensus among all interested parties on principles or policy frameworks to guide the conservation and utilization of wild Pacific salmon fisheries (FRSPRB, 1995; PPRT, 1995; May, 1996; Toy, 1998). "This is by no means a pejorative conclusion but simply a

statement of reality,” says Dr. A.W. May in his report on allocation issues between user groups (May, 1996: ix). In this same direction, Toy (1998: 22) points out that “consensus is not, was not and probably never will be literally possible given the diversity of interests of people who participate directly and indirectly in the Pacific salmon fishery.” The three major sectors involved in the utilization of salmon resources have fundamentally different interests and views about practices implemented by DFO which, given the need to achieve a balance between resource availability and fleet capacity to exploit the resource, cannot avoid negative consequences somewhere (May, 1996). And stakeholder hardly agree on policies that cause negative economic consequences at the community level, reductions in overall employment, and negative impact on individual enterprises.

Intensive and constant conflicts between users lead to a general lack of cooperation among sectors which hinders proper management of the stocks, and diminishes opportunities for stakeholders to work together in support of conservation and an economically viable, sustainable fishery (May, 1996; DFO, 1998a). This case study shows that there was no realistic possibility of reaching broadly acceptable compromises between Aboriginal, commercial or recreational interests, with the single exception of a general commitment to resource conservation. Likewise, it was unlikely that consensus on allocation issues could have been achieved with other levels of government, whether provincial or municipal. As indicated in the May report, “while the status quo is undesirable, not all stakeholders groups can be satisfied no matter what direction from the status quo we move” (1996:13). This polarization means that there was no possibility of building consensus among stakeholders on solutions to achieve biological and economic sustainability of wild Pacific salmon. Conflicts were therefore generated not only due to discrepancies about the causes of a crisis, but also due to disagreements around beliefs about causation and preferences about outcomes (Thompson and Tuden, 1959). In terms of causation (i.e., means), there were disagreements about what will happen if one of the decision alternatives was chosen; whereas, in terms of preferences (i.e., ends) it means that there were disagreements over which outcomes were preferred.

Conflicts are thus a characteristic feature of environmental politics and the search of sustainable development (Lee, 1993), and of wicked sustainability problems in particular. Divergent stakeholders’ values collide, and disagreements about causes of a problem and

about preferred courses of action are always present when environmental questions and issues are complex and often lacking a definitive answer. Disputes between stakeholders trying to impose or negotiate their frame of reference to make a problem intelligible create decision situations where conflicts are inevitable and government interventions indispensable. In this regard, the government plays a major role in attending and solving conflicts around environmental (wicked) issues for at least two reasons: because the scientific complexity of environmental problems can be illuminated or resolved only through publicly supported research and/or investigations, and because environmental quality is a public good that cannot be allocated following a market-oriented logic (Lee, 1993).

The two attention cycles analyzed here show that the preferred way to deal with a high level of conflicts between stakeholders and against DFO is outsourcing executive attention capacities to external, independent bodies of experts. Their main role is not to eliminate conflicts –which is an impossible task given the wickedness of the problem– but to make conflicts productive by altering traditional decision-making process in a way that it will help the parties in dispute achieve consensus on preferred outcomes (e.g., conservation) as a prelude to joint planning and management. At the same time, it helps DFO's decisions to win acceptance in the wider society as the preferred solutions and outcomes are decided in a collegial, consultative structure. The goal is not to achieve a final resolution of conflict, but rather to hammer out joint actions in contexts where all involved parties are aware of, and retain, opposed interests. Thus, conflicts can proceed productively if they permit and encourage the articulation and defense of contending values, such as conservation and utilization of the resource, and the exploration of competing ideas, options and insights for problem solving (Lee, 1993; Cuppen, 2012).

## **Conclusions**

Case study is one of the most, if not the most, popular type of qualitative research and the preferred research approach to the analysis of wicked problems, as shown in Chapter 4. A recent review of over 100 case studies published in SAGE journals in 2017 shows, however, that the vast majority of those articles did not include any discussion of the type of case study under examination (e.g., explanatory, exploratory, single- or multiple-cases), its specific methodological foundations, or how the authors defined or bounded a

particular case (Salmons, 2018). I found similar methodological weaknesses in the systematic review of empirical research on wicked sustainability problems: less than 50% of reviewed items explicitly mention the data collection techniques and data analysis strategy applied to conduct the empirical case study.

In contrast, the use of event-structure analysis (ESA) in this case study research offers a reliable, systematic methodological approach to study a contemporary phenomenon within some real-life context that is explored by triangulating multiple data sources. The determination of causality presented here is a judgment based on theoretical deduction, historical generalization and comparison, and a wide array of evidence and theory, rather than a fact given naturally by the events' linear temporal order. By answering ETHNO's questions to causally structure a sequence of events, I was able to synthesize: (i) the knowledge of the historical particulars of managing BC salmon fisheries in the 90s; (ii) a novice approach to collective attention on complex, uncertain and dynamic problems that cannot be easily defined and solved; and (iii) historical generalizations about social conflicts in a policy subsystem, and how they define policy responses around socio-ecological issues. Similarly, the diagrams resulting from ESA are instructive for at least two interrelated reasons: they portrait causal imputations and assumptions about how and why events (issues and answers) are linked as they are, or are not linked at all; and they help discerning non-mechanical organizational patterns by comprehending better how previous events conditioned current events and how current events, in turn, shape the range of future possibilities and alternatives.

Talking more specifically about the findings of this study, it highlights the limitation of extant theories of attention to analyze wicked problems. Similarly to punctuated decision making models, attention on wicked problems is triggered by a crisis (in this case, an ecological crisis) addressed through a series of interrelated responses. However, government responses are not necessarily motivated by the search of a definite solution to the problem at hand but by a reduction of permanent conflicts and/or the need to make social conflicts to proceed productively.

The corollary of this study is that a manageable level of conflict may be always desirable as it can provide ways to recognize errors (as with the Mifflin Plan) and to stimulate social learning, and it can also be indispensable as an integrating mechanism

(Lee, 1993). Too much conflict, however, can frustrate the learning necessary to reach sustainability, information sharing –which can be understood as a sign of trust–, and error-correcting capabilities. The challenge for the government is to keep conflicts within bounds in such a way that it is possible to maintain a level of institutional cooperation and stability capable of planning, implementing and monitoring activities over the length and breadth of large ecosystems and periods of time that are biologically relevant for the species to be sustainably managed. Further theoretical and practical implications of this study are discussed in the next chapter.

## Chapter 9. Conclusions

“Our situation is not comparable to anything in the past. It is impossible, therefore, to apply methods and measures which at an earlier age might have been sufficient. We must revolutionize our thinking, revolutionize our actions [...] Clichés of yesterday will no longer do today, and will, no doubt, be hopelessly out of date tomorrow.” This is an excerpt of Albert Einstein’s (1948: 299) message to the World Congress of Intellectuals talking about global peace and the need of changing deep-rooted nationalist traditions in a radical fashion. Seventy years later, in a complete different context, this phrase can be considered a valid explanation of how we should try to approach wicked problems of our days, and also how social scientists should conduct research able to address wicked problems. We cannot expect to build a solid body of theoretical and empirical knowledge that contributes to innovative and transformative solutions to wicked problems if we keep approaching these issues in the same way, basically from a normative point of view or through case studies only. If we, social scientists, want to make a real impact on the process of solving a wicked problem, we need to enter into a completely different level of awareness and step away from the problem at hand to look at it from a different perspective.

Convinced of the same, I embarked in a five-year journey to study wicked problems from a different angle, advancing on an area that has received little interest in the mainstream organizational literature –the nexus between government attention and wicked problems– and using a variety of systematic and reliable methods for analyzing empirically how public organizations and decision makers deal with uncertain, complex and dynamic social and ecological issues. I developed a descripto-explanatory study to government attention on wicked problems as a two-level phenomenon (the individual and the organizational) through three studies that are connected to illustrate basic constituent elements of attentional processes at both levels: a stimulus (i.e., a process input), the perception of the stimulus (i.e., framing stage), and the visible actions taken as a response to the way in which the stimulus was perceived (i.e., process output) (Kahneman, 1973). Each study involves different research designs and levels of analysis, viz.: (i) a systematic qualitative review of empirical research on wicked problems (conceptual level

of analysis), (ii) a series of psychological experiments based on realistic hypothetical decision making scenarios (individual level), and (iii) a case study of the Department of Fisheries and Oceans of Canada (organizational level).

The **first study** analyzes key attributes of wicked problems that turn them into stimuli difficult to be addressed using extant models of government attention and traditional decision making approaches. This study surveys and synthesizes in a systematic way theories and empirical research that analyze wicked problems in the field of sustainability/sustainable development, the plurality of existing definitions and a variety of problem solving approaches that proved to be successful in dealing with wicked problems. Through this study I was able to present a state-of-the art of the existing literature on wicked policy problems; to develop a conceptual framework that explains the main sources of wickedness of public policy problems and their consequences for policy making/problem solving at government organizations; and to suggest a series of propositions that help to increase the success of problem-solving approaches to wicked sustainability problems.

One of the current critiques against Rittel and Webber's (1973) work is that the wicked problems they focused on to develop their theory do not necessarily represent the types of problems that decision makers in the public sector face today (Mascarenhas, 2009; Rayner, 2006; Crane and Landis, 2010; Andersson and Lehtola, 2011). To arrive to a better understanding of wicked problems that public managers of the 21<sup>st</sup> century face on a regular basis, I decided to conduct the systematic synthesis using a sample of 32 empirical studies on sustainability-related issues due to the following reasons. First, from the late 1980s the global environmentalist movement and progressive global governance has had growing influence and made significant efforts to implement sustainability-oriented policies. This has caused a fundamental review of government thinking towards the environment and demanding tangible action and resources across a broad range of policy fields (Adams, 2011; Acuto, 2012). Second, approaching sustainability as if it were a wicked problem -rather than a tame issue- provides a more realistic framework to guide implicated actors in engaging effectively with the real aspects of a problem and achieving more sustainable solutions (Herrick and Pratt, 2012; Scherrer and Doohan, 2014). Third, sustainability policies are currently a major focus of public and institutional

attention, ranking higher on the executive and legislative agendas of many governments, intergovernmental bodies, companies and civil society organizations now leading initiatives which incorporate sustainability into their operating strategies (Williams, 2006; Herrick and Pratt, 2012; Pieters et al., 2012). Models of sustainability and sustainable operations are indeed emerging across almost all levels and sectors of society –including water utilities, logistics service providers, food production, urban planning and more– providing the opportunity of analyzing dynamic social processes requiring continuous capability building and attention management (Herrick and Pratt, 2012; Andeweg and van Latesteijn, 2011). The focus on sustainability problems has been extended to the other two studies, as explained below.

The **second study** analyzes the perception component of the attention process that shapes attention allocation and provides incentives and/or preferences for certain actions over others. Based on an experimental research design, I investigated how arbitrary changes in the presentation of a wicked issue (i.e., *problem framing*) affect policy decisions. The study was designed to test the presence of a series of behavioural anomalies and decision biases when people tend to reason about wicked problems in scenarios involving policy decisions in the field of socio-ecological sustainability. I test statistically if prospect theory (Tversky and Kahneman, 1981), which is a decision theory different than the rational choice model that Rittel and Webber (1973) criticize, could provide a better explanation of how people try to solve wicked problems.

When different stories and narratives can be told about the same set of facts –as it commonly happens with wicked problems–, framing involves shaping the terms of political and social debate by defining the issue, the causes and the solutions. This is, what is the problem? Who is to blame? How can positive change be effected? Who is responsible for taking action? Problem framing thus reflects wide social, political and economic concerns, and it has an influence on policy responses and on the attitude of the target audience regarding those responses (Shaw and Crowther, 2017). Better understanding how problem framing and behavioural biases operate at an individual level, influencing the experience and perception of acts, policy outcomes and surrounding contingencies (Tversky and Kahneman, 1981), contributes to the development of a more

realistic organizational theory of attention able to better explain how we attend and respond to wicked problems.

The **third study** analyzes the outputs of attention allocation processes in a public organization. I conducted a case study that explains how two types of events interrelate to make up an organizational process of attention, viz.: the *issues* that are identified as critical and important in matters related to the sustainability of Pacific salmon in British Columbia as a wicked problem, and the *answers* deployed by the Department of Fisheries and Oceans (DFO) to deal with it during two attention cycles, 1990-93 and 1994-98. This process study of multiple event sequences was aimed at identifying the interrelationship of problems and responses over time, and explaining causal underlying mechanisms and patterns rather than testing for causal effects. By treating government responses as components of an event sequence, it was possible to determine if certain answers either made the attention process change direction, contributed to a further continuation along the current path, or initiated a complete new process.

Through the observation, representation and analysis of patterns of events, this study provides a better understanding of how wicked problems evolve and which government interventions are realized over time, determining some form of causality that explains why certain responses to a wicked problem have been applied in such specific context and period of time. Applying the event-structure analysis (ESA) methodology, I was able to infer causal relations, mechanisms and contingencies that helped or restrained DFO to focus and sustain attention on the problem, why certain events happened in the organizational process under examination, and how stakeholders responded those events.

What follows is a synthesis of the responses provided by each of the three studies to the research questions presented in the introductory chapter and the discussion of their practical and theoretical implications.

*What are the main sources of wickedness of public policy problems? What are the challenges that such sources of wickedness pose for policy making/problem solving processes in the public sector? What are the problem-solving strategies that have been successful in addressing wicked policy problems? What are the factors that contribute to the success or failure of such solutions?*

Through a systematic synthesis of empirical research on wicked sustainability problems in different contexts and policy areas, five major themes were identified as the main factors that make a policy problem *wicked* in the field of sustainable development: lack of consensus (i.e., conflicting notions of a wicked sustainability problem); uncertainty; complexity; dynamism; and sustainable solutions as wicked problems (i.e., wicked solutions). Similarly, the four strategies that most frequently appear in the reviewed literature as successful problem-solving approaches to wicked sustainability problems are: system innovation; network-based/collaborative governance; adaptive management; and multi-stakeholder engagement.

Based on the first five themes, I developed a general conceptual framework on the wickedness of sustainability problems that is made up of four dimensions: Stakeholders divergence, Co-existing uncertainties, Institutional complexity, and Environmental dynamism. Each of them has its main sources of wickedness and implications for attention and problem-solving processes within the public sector.

**Stakeholder divergence** refers to the fact that implicated coalitions of stakeholders frame the problem at hand based on competing belief systems creating unclear, disputed definitions of a wicked sustainability problem. The more irreconcilable the belief coalitions are, the more difficult it is to engage other value-divergent stakeholders in the wicked problem-solving process. As a consequence, the much needed collaboration and participation of diverse stakeholders to arrive at joint solutions is undermined.

In the quest to objectively establish management models as solutions to wicked sustainability problems it is often wrongly assumed that there is an overriding social ethic or collective problem perception (Segrave et al., 2012). On the contrary, the reviewed literature shows that there are actually multiple frames of reference and interpretations at play that lead to divergent understandings and values attributed to the phenomenon at hand. Conflicting values explains why sustainability and sustainable development related problems are wicked; they are indeed the heart of Rittel and Webber's theory (Norton, 2005).

**Institutional complexity** indicates the complicated entanglement of vertical and horizontal governance systems where responsibility is dissected and dispersed among a variety of governmental agencies and non-governmental organizations. The dispersion of

responsibility at national, provincial and local levels, and within and outside the public sector, tends to inhibit the integration of perspectives necessary for decisions, policies and programs supporting sustainability goals. As a consequence of vertical and horizontal institutional complexity, the level of awareness and attention on a wicked sustainability problem among implicated stakeholders varies extensively and the issue is far from being prioritized on all agendas.

This wicked feature of sustainability problems poses additional challenges to the prescribed collaboration between the community, government and non-government organizations, and the achievement of concerted solutions among coalitions of stakeholders. The institutional complexity of sustainability problems is increased by the presence of multi-level and multi-actor policy structures (Sandström, 2013; Williams, 2006). Paradoxically, these institutional structures and cross-scale linkages are absolutely crucial for arriving at collaborative, multidisciplinary efforts capable of dealing with wicked sustainability problem in a successful way.

**Co-existing uncertainties** refers to limitations of current knowledges on the initial conditions, consequences and interaction of ecological, political and social variables, which make extremely difficult to anticipate the consequences of any proposed solution aimed at resolving a wicked problem. The simultaneous presence of different types of uncertainties –not only about ecological factors and conditions, but also about social and political interactions– further complicates the different stages of policy making and explains in part the difficulties of linking scientific knowledge and practice to arrive at successful solutions to wicked problems.

**Environmental dynamism** describes the constant and high-speed variations in market conditions, political alliances, implicated actors and ecological variables, which make sustainable solutions to change at a rapid pace. The dynamic dimension of a wicked issue determines the extent to which the problem and the solutions change or remain stable: the more dynamic the environment surrounding a wicked problem is, the more unstable the implemented solutions will be. This dimension of sustainability problems implies that today's solution will lead to a new problem formulation and new forms of competing claims and interests while attempting to develop sustainable solutions.

This study reveals the central role of environmental dynamism in explaining the wickedness of a socio-ecological problem as it has a critical influence on the other three dimensions. On the one hand, it contributes to generating higher levels of stakeholder divergence over problem definition-as constant modifications in local and global factors raise challenges for knowing what those factors are, how they interplay and what their consequences are. In fact, understanding the importance of various dynamics in time and space requires also an understanding of the goals and values that define a wicked problem (Norton, 2005). On the other hand, environmental dynamism also affects the level of uncertainties surrounding a wicked problem. Given the fast pace of change in ecological, socio-political and economical variables, it is practically impossible for a single player to have the needed information, knowledge and capacity to univocally design and implement effective solutions. Finally, the dynamic dimension of a wicked problem compels implicated stakeholders to work together in horizontal and vertical governance systems that, while improving the chances of success, also increase institutional complexity and dispersion of responsibility among stakeholders.

Study #1 ends with a series of five practical propositions that may help reduce the wicked effects of sustainability problems on policy making and overcome fragmented government action. A key message coming from these propositions is that prescribed solutions to a wicked problem should not be initially focused on resolving the problem, but on guaranteeing that government responses are effectively integrated into a new working logic and that public officials have the required instruments to execute actions in that new logic. The propositions suggest that success factors for integrated wicked-problem solving approaches are, first, the involvement of actors from multiple policy sectors and non-governmental spheres to improve policy alignment in terms of power and resources (e.g., Williams, 2006; Gollagher and Hartz-Karp, 2013; Ozerol et al., 2012; Hospes et al., 2012). Second, it is important to establish and maintain interdisciplinary research efforts across all policy sectors to improve the integration of governance levels at which the issue is dealt with, the definition of the problem in terms of the nature and size of the wicked problem at hand, and the prioritization of sectoral goals within multiple dimensions (Gollagher and Hartz-Karp, 2013; Ozerol et al., 2012).

*How does the framing of a wicked problem affect the way in which solutions are perceived? What are the factors that explain the influence of framing on attention and decision making at individual level?*

The second study confirms that key principles of prospect theory apply to risky decisions involving solutions to wicked sustainability problems. I provided evidence that people are affected by framing effects in hypothetical but realistic decision making scenarios, which are contrary to the predictions of normative theories of choice and rationality that Rittel and Webber (1973) challenged in their original theory of wicked problems.

The findings demonstrate that people are relatively more susceptible to framing effects in contexts involving non-wicked problems than in those about wicked sustainability problems. This behaviour is explained through two moderating factors: susceptibility to framing and protected values regarding the environment. When people make decisions around sustainability problems, those who give relatively more weight to preservation attitudes and ecological behaviours regarding the environment are less susceptible to framing effects, whereas the more the participants agree with instrumental use of nature in favour of human beings, the more they are affected by framing effects .

There are four key lessons coming from this study regarding the implications of identified decision biases for both policy making and attention processes on wicked problems. First, some authors suggest that framing effects are indicative of a shallow approach to decision making and they are largely attributable to people's lack of attention and of careful thought about their choices. Alternatively, another view proposes that framing effects are likely to persist even among careful thinkers, since they have an evolutionary basis and emerge from sincere attitudes rather than careless processing. Studies that have examined these issues have been limited in scope and have yielded mixed results (see Lebouef and Shafir, 2003 for a review). Nevertheless, there seems to be a relatively consistent tendency on the **effects of loss aversion** on attention: the classic ADE (Tversky and Kahneman, 1981) and my problems 1.1 and 1.2 reveal that people are more likely to take risks when options focus attention on the chance to avoid losses than when options focus on the chance to realize gains. In other words, due to loss aversion, negative wording that focuses participants' attention on avoiding a loss may produce

greater force than comparable positive wording that focuses on obtaining a gain. As a consequence, looming losses may encourage actors to accept policies that they might otherwise reject.

In line with the attention-based view of losses developed by Yechiam and Hochman (2013), it is fair to argue that, because of loss aversion, losses lead to more attention than to equivalent gains and affect the decision to whether to invest time, resources and attentional capacities in the task at hand, and if so, how much. On the positive side, orienting responses to losses can increase arousal, lead to greater focusing, enhance the ability to ignore irrelevant stimuli and reduce random responses (Yechiam and Hochman, 2013; Kahneman, 1973). On the negative side, framing manipulations that increase loss aversion may create attentional biases that can have a dramatic impact on the decision-making process, leading people to make bad or inaccurate choices. Since people can become overly focused on a single stimulus (e.g., rare events or crises), they might neglect to notice other wicked aspects of a situation.

In addition, as pointed out by Quattrone and Tversky (1988), loss aversion may play an important role in bargaining and negotiation as it may hinder the process of making compromises and concessions to other stakeholders. Because every party may view its own concessions as losses that loom larger than the gains achieved by the concessions of unlikely allies, this bias may be particularly problematic when dealing with wicked issues that need multi-stakeholder collaboration and agreements to be solved. In this regard, Mercer (2005) argues that loss aversion may be key to understanding, for instance, when a threat or a promise works best in political strategic interactions: threats should be most effective against actors who seek gains and least effective against actors who seek to avoid losses, whereas promises should be most effective against actors who seek to avoid losses and least effective against those who seek gains. If prospect theory leads us to expect fear of loss more than hope for gain, then putting emphasis on threats is likely to cause more conflict among stakeholders, not deter it, thus reducing the possibility of arriving at joint solutions to wicked problems.

Second, regarding the effects of the **status quo bias**, various authors have already pointed out its implications when it comes to voting behaviour. When the general conditions are good or acceptable the status quo bias gives the incumbent politician (i.e.,

the reference point) an advantage over the rival candidates (see Quattrone and Tversky, 1988; Frey and Eichenberger, 1991; Fatas et al., 2015). Study #2 suggests that the status quo bias has also policy implications when people have to decide how to solve a wicked sustainability problem: due to loss aversion, they are more motivated to do nothing or to maintain current or previous decisions unless the current conditions become totally unacceptable. The status quo bias can thus prevent taking uncertain actions that may cause less harm than the current state of affairs.

This bias fuels conservative tendencies that are an impediment to adopt some of the strategies that most frequently appear in the reviewed empirical literature as successful problem-solving approaches to wicked problems: e.g., new ways of co-creating knowledge, new forms of collaboration and new partnership arrangements between different levels of government, industries and communities. The “irrational” preference for the status quo may entail forfeiting certain positive consequences of these problem-solving approaches, because the forfeited gains are psychologically given less weight than the losses that would be incurred if the status quo were changed (Bostrom and Ord, 2006). Better understanding when, and why, people will behave in a risk-averse or risk-acceptant way, or how they would respond to changes in the reference points and in the perceived status quo, can definitely help in setting political strategic interactions to deal with a wicked problem.

Third, Study #2 also suggests that the **certainty effect**, which makes people to overweigh events of low probabilities and to over-proportionally under-weigh events of moderate and high probabilities, leads decision makers to focus on very salient stimuli (e.g., rare events and/or crises) while more subjacent, silent events whose negative effects accumulate over time creating a wicked problem may not be perceived. Finally, the sustainability problems used in Study #2 demonstrate that, due to the **ratio-difference** principle, the way in which probabilistic risk information about a wicked problem is presented has the potential to influence perceptions of risk and decision-making. In both cases a simple reframing of a problem in a specific way (i.e., certain, positive) may encourage actors to support policies with high ecological impact that they may have never accepted otherwise.

In general terms, this study demonstrates that people are affected by framing manipulations in a variety of decision making scenarios and suggests that, although these effects are not necessarily the result of lack of attention to the way a problem is framed, they have implications for the process of attention itself. In particular, given that prospect theory offers the possibility of anticipating people's attitudes toward risk and certain "irrational" behaviours, the study highlights that a strategic exploitation of such anomalies can help to better reach consensus about sustainability issues if they are used effectively by politicians and other powerful interests to gain support for their side. The strategic use of cognitive biases and framing manipulations that activate them can indeed reduce stakeholders' divergence, increase support to policies and arrive to joint solutions to wicked problems.

These findings make a contribution to the extant literature that provides evidence that manipulations of problem frames can shape preferences and generate more or less support for one policy alternative instead of another depending on the perceived strength of political arguments and what impact they have on information processing and judgment (Druckman, 2001; Chong and Druckman, 2007; Arceneux, 2012; Ledgerwood and Boydston, 2014). This study is also in line with previous research that has pointed out that message manipulations that increase loss aversion in particular can be used to deliberately gain support for one policy alternative instead of another, better reach one's own goals, and/or influence public preferences and opinion (see Chong and Druckman, 2007). The study provides evidence that suggests that if a political faction is able to activate cognitive biases when positioning their preferred alternative, it may gain an advantage in political discourse because cognitive biases may alter the attractiveness of prospective solutions and influence the perceived persuasiveness of arguments.

Despite these useful contributions for the future development of an alternative theory of attention on wicked problems, it has to be recognized that further research is still needed to better understand how prospect theory, a theory of individual choice under risk –not a general theory of politics or a complete theory of decision-making (Levy, 2003)– can be applied to involve choices, responses and attention patterns of collective decision making bodies, such as public organizations, dealing with complex, uncertain, conflicting and dynamic problems.

*How does the attention process of public organizations on a wicked problem emerge, develop, and (perhaps) eventually decay? What are the main policy patterns and outcomes that attention processes on wicked problems generate over time at an organizational/collective level of analysis?*

The case of the sustainability of Pacific salmon (SPS) as a wicked problem was analyzed adopting a process approach that opened the black box between attentional inputs and outcomes, exhibiting why and how certain issues cause specific governmental responses in a specific time (1990-93 and 1994-98) and space (the Fraser River in British Columbia, Canada). This third study helps to overcome theoretical limitations of the extant literature on government attention to address with very challenging, long-standing societal issues that are currently absent from mainstream theories of organizational attention.

The study describes, first, how a wicked problem evolves over time until it receives the attention of political and bureaucratic structures. The comparison of two attention cycles shows a similar pattern: a variety of events that are not easily identifiable in time and space (e.g., weather disturbances, budget cuts, organizational restructuring) have negative effects that interrelate and cumulate over time until they create a societal/ecological crisis that put in motion a series of formal interventions not always consistent and well coordinated. Contrary to mainstream theories of collective attention that see a crisis as a discrete event with well-defined temporal and spatial boundaries that initiates the processes of attention selection and allocation, this study shows that, when it comes to wicked problems, a crisis (e.g., the disappearance of millions of fish) is just an intermediate step in a sequence of events and it is not necessarily the most important one where public organizations decide to focus their attention upon. The events that receive more or less attention –regardless of being a “crisis” or not– are dependent on the degree of **conflict** generated around definitions of the problem, attributions of responsibility and preferred solutions, rather than on the magnitude of the event in terms of ecological damage or its economic consequences for coastal and fishing communities.

Second, Study #3 provides evidence that the degree of conflict is explained in part by the **expectations** of the user groups at the beginning of each season and the possibility or not of fulfilling such expectations. When expectations are high but are not fulfilled due to

a critical event, the higher the degree of conflicts will be. The more intense and repetitive a social conflict in the policy subsystem is, the more it affects **public confidence**, and the longer the attention of the government on a particular issue will be sustained. The government is then urged to take action to both reduce conflicts and regain public confidence, not necessarily to solve the initial problems that created such conflicts.

The finding about the role of expectation in generating social conflicts is in line with the work of Balint et al. (2011) on wicked environmental problems. Balint and his colleagues suggest that expectations may create a social problem when multiple people see that their valued expectations are not met, when their expectation is deemed sufficiently important to warrant action, and when the dissonance between expectations and reality exceed some level of acceptability. My study shows that in the case of the SPS as a wicked problem, there is nearly always disagreement on which expectations are not being met (i.e., which constituency's and/or user group's expectations are unsatisfied), on the relative importance of those expectations for the government and other stakeholders, and the appropriate thresholds of acceptability of dissonance between what constituencies were expecting at the beginning of each season and the real returns during the season.

This idea of a **conflict-driven attention process** resonates with the works of Sullivan (2010) and Hoffman and Ocasio (2001) on the *urgency effect* and the *attribution of accountability*, respectively, as critical factors determining how decision makers allocate attention to some problems in detriment of others. Following Sullivan (2010), this study shows that, as a public agency, DFO is under constant pressure to show the public that it is producing something that is beneficial to the public, despite the fact the wicked problem and/or crisis at hand cannot be actually solved. As a result of that public pressure to take action, DFO tends to favour "easy solutions" with limited real impact (e.g., closure of the fishing season) over more complex actions. In line with Hoffman and Ocasio (2001), the SPS case suggests that when a crisis is framed in the public media and in the constituencies' eyes in a way that holds DFO accountable for such events, it undermines the public confidence on the agency's management capacities; only then the level of government attention is increased and more complex solutions are favoured (e.g. comprehensive multi-annual actions plans).

The third relevant lesson is that, once a crisis becomes evident, traditional measures fail, conflicts emerge and the public trust on government is eroded, the government outsources **executive attention capabilities** to an independent body. As in the case of novel situations or non-routine activities (Ocasio, 2011), this strategy helps DFO to guide cognition and action in wicked situations where there are no predetermined schemas to achieve goals or task demands or when there are conflicts among goals. For the government, relying on external consultative bodies for making decisions is a means to frame the problem and legitimize future actions. As the level of confidence is a byproduct of the decision process (Balint et al., 2011), due to co-existing uncertainties about policy outcomes and the consequences of taking a particular course of action, it is important for the government to implement framing and decision processes that are independent, transparent, open and engender trust among stakeholders. With such public trust regained conflicts may be reduced because participants are more likely to accept the problem frame and the actual outcomes as being “fair” (Balint et al., 2011) even though such outcomes may not be what stakeholders had hope for.

Overall, this study suggests that attention allocation of a public organization on a wicked problem needs to be understood not as a mechanical process where information is assembled and debated and decisions reached –like conveyers belt in assembly line–, but as an “organized anarchy” where solution proposals and alternatives resemble more a process of biological natural selection (Cohen, March and Olsen, 1972; Kingdon, 1984). Decision situations characterized as organized anarchies share three general properties that are particularly relevant for this study. First, decision makers operate on the basis of inconsistent and ill-defined preferences that make difficult to impute a set of preferences to the decision situation in a way that satisfies the standard consistency requirements for a theory of rational choice. In other words, actions are not necessarily based on clear, pre-defined preferences, but preferences are actually discovered through action, as it was demonstrated in Study #2. Second, decisions are made on the basis of simple trial-and-error procedures, the residue of learning from the accidents of past experiences, and pragmatic actions and inventions that are product of necessity and/or urgency, as argued above. Third, participants vary in the amount of time and effort (i.e., *attention*) they devote to different decision domains, and their involvement varies from one time to

another (Cohen et al., 1972). This conceptualization of an attention process as an organized anarchy resonates with Dutton et al.'s (2001) argument that the attention process –particularly on wicked problems– is much more political and contextually embedded than it is assumed in the agenda setting literature and in punctuated decision making models.

### **Final thoughts**

According to what it has been exposed in this research, it results clear that identifying a policy problem as *wicked* –and understanding its sources of *wickedness*– is not about semantics or the creative use of another existing problem typology (e.g., Ackhoff, 1974; Simon, 1973). It has at least three implications for policymaking and how government affairs should be conducted. First, recognizing a problem as wicked provides a means to understanding why some of the traditional analyses and responses applied to major societal problems produce disappointing results. The lack of recognition and understanding of the true inherent wicked nature of some social-ecological problems and, more importantly, how to deal with them contribute to chronic policy failures (Borrone, 2005; the Australian Public Service Commission [APSC], 2007; Weber and Khademanian, 2008; Scherrer and Doohan, 2014). Let's think of global warming, for instance: when it first emerged as a trans-national problem some of the responses concentrated on solving it through traditional, normal science manifested in the development of biofuels to replace fossil fuels with a climate-friendly and sustainable source of energy. We know now, however, that the production of biofuels exposes other unpredictable and complex socio-ecological challenges, such as land use issues, loss of biodiversity and higher food prices, that in turn can result in endless unsolved outcomes that require post-normal science to be effectively addressed (Grint, 2008; Gollagher and Hartz-Karp, 2013).

Second, framing complex problems as wicked allows for multiple ways of thinking through issues which are not possible if they are framed as crises, disasters or tame problems that usually require a problem-solving strategy that is largely expert driven (Kreuter et al., 2004; Kameniar, Imtoul and Bradley, 2010). Attending to a wicked policy problem clearly differs to attending to critical events –such as an oil spill disaster– that demand short-term, episodic, punctuated allocations of problem-solving capacity and resources. The ephemeral aspect of collective attention is, however, a major obstacle to

long-term, open ended and dynamic wicked problems that require sustained attention and concerted efforts to develop responses over a long period of time (APSC, 2007; Jentoft and Chuenpagdee, 2009). The (re)conceptualization of policy issues as wicked problems enables governmental and non-governmental actors to collectively and explicitly recognize fundamental and conflicting perspectives (Logue, 2009). It provides a platform from which policy-makers can pursue a range of policy responses that embrace different perspectives, rather than spend time and attentional resources in attempting to achieve a single definitive problem definition and policy response.

Finally, wicked problems challenge government-based hierarchies and markets as the most effective ways of organizing to address complex problems, share scarce resources and take joint action. Networks, partnerships and different forms of participatory governance appear as the foremost platforms to encourage the participation of diverse stakeholders in collectively crafting policy recommendations to decision-makers with legal authority to adopt, implement, and enforce them. A key task for public servants dealing with wicked problems is to provide the network management support and the mechanisms to bring individual and institutional members together, allowing for various forms and degrees of engagement with the general public (Cunningham et al., 2012; Gollagher and Hartz-Karp, 2013).

Rather than trying to keep solving wicked problems from a narrow, purely instrumental managerial logic, public officials need to play an important role as *network facilitators* to create the conditions which enable interactions among stakeholders (Schmitt, 2010) and/or as *knowledge brokers* to keep interactions going between different partners and to use various forms of knowledge they together co-create (Bouma et al., 2011; Cunningham et al., 2012). Since a wicked problem has no optimal solution, public managers –who are still required to act– should be released from allocating resources, personnel, time and effort (i.e., attention) to the impossible task of finding the one correct response. The attention of network- and knowledge-brokers in the public sector should be put instead on: facilitating progress despite discrepancies among constituencies by integrating deliberation and social values (e.g., utilization and conservation of the environment) into technical analysis when making environmental decisions; fostering public trust in the proposed actions, the implementing institutions and their technical

expertise; understanding how social, political, ecological and scientific parameters change over time (sometimes making an *answer* turn into an *issue*); and making stakeholders participation and engagement absolutely essential as a basis for policy and decision-making.

## Bibliography

- Abbott, A. (1988). Transcending General Linear Reality. *Sociological Theory*, 6(2), 169-186.
- Abbott, A. (1992). From Causes to Events: Notes on Narrative Positivism. *Sociological Methods and Research*, 20(4), 428-455.
- Abebe, M. A. (2012). Executive attention patterns, environmental dynamism and corporate turnaround performance. *Leadership and Organization Development Journal*, 33(7), 684-701.
- Acheson, K., Maule, C. J. and Filleul, E. (1996). Cultural Entrepreneurship and the Banff Television Festival. *Journal of Cultural Economics*, 20, 321-339.
- Ackoff, R. L. (1974). *Redesigning the future: a systems approach to societal problems*. New York : Wiley.
- Acuto, M. (2012). Ain't About Politics? The Wicked Power-Geometry of Sydney's Greening Governance. *International Journal of Urban and Regional Research*, 36(2), 381-399.
- Adams, D. (2011). The 'Wicked Problem' of Planning for Housing Development. *Housing Studies*, 26(6), 951-960.
- Allan, C. (2012). Rethinking the 'Project': Bridging The Polarized Discourses in IWRM. *Journal of Environmental Policy and Planning*, 14(3), 231-241.
- Almond, G. A. and Powell, G. B. (1966). *Comparative Politics: A Developmental Approach*. Boston: Little, Brown
- Ananiadou, S., Rea, B., Okazaki, N., Procter, R. and Thomas, J. (2009). Supporting Systematic Reviews Using Text Mining. *Social Science Computer Review*, 27(4), 509-523.

- Anderson, P. F. (2013). What's Wrong With Google Scholar for "Systematic" Reviews [Blog post]. Available at <https://etechlib.wordpress.com/2013/01/23/whats-wrong-with-google-scholar-for-systematic-reviews/>
- Andersson, A. and Ullah, F. (2014). The Condition of Smallness: How What It Means to Be Small Deters Firms From Getting Bigger. *Management Decision*, 52(2), 326-349.
- Andersson, K. and Lehtola, M. (2011). Regulating the New Equine Industry in Finland. Wicked Problems, Governance Models and Gendered Power Structures. *Sociologia Ruralis*, 51(4), 387-403.
- Andeweg, K. and Van Latesteijn, H. (2011). Transforming Agriculture: A New Approach to Stimulate Sustainable Development. In Andeweg and Van Latesteijn (Eds.), *The Transforum Model: Transforming Agro Innovation Toward Sustainable Development*, 131-144. Springer Science+Business Media B.V.
- Anthony, R. (2012). Taming the Unruly Side of Ethics: Overcoming Challenges of A Bottom-Up Approach to Ethics in The Areas of Food Policy and Climate Change. *J Agric Environ Ethics*, 25, 813-841.
- Arceneux, K. (2012). Cognitive Biases and the Strength of Political Arguments. *Journal of Political Science*, 56(2), 271-285.
- Argote, L. and Greve, H. R. (2007). A Behavioral Theory of the Firm—40 Years and Counting: Introduction and Impact. *Organization Science*, 18(3), 337-349.
- Ariza-Montobbio, P. and Farrell, K. N. (2012). Wind Farm Siting and Protected Areas in Catalonia: Planning Alternatives or Reproducing 'One-Dimensional Thinking'? *Sustainability*, 4, 3180-3205.
- Australian Public Service Commission [APSC] (2007). *Tackling Wicked Problems. A Public Policy Perspective*. Available at: [http://Www.Apsc.Gov.Au/\\_Data/Assets/Pdf\\_File/0005/6386/Wickedproblems.Pdf](http://Www.Apsc.Gov.Au/_Data/Assets/Pdf_File/0005/6386/Wickedproblems.Pdf)
- Bal, P., Nath, C. D., Nanaya, K. M. et al. (2011). Elephants also Like Coffee: Trends and Drivers of Human-Elephant Conflicts in Coffee Agroforestry Landscapes of Kodagu, Western Ghats, India. *Environmental Management*, 47, 789-801.

- Balint, P. J., Stewart, R. E., Desai, A. and Walters, L. C. (2011). *Wicked Environmental Problems. Managing Uncertainty and Conflict*. Washington D.C.: Island Press.
- Bardach, E. (2009). *A Practical Guide for Policy Analysis. The Eightfold Path to More Effective Problem Solving* (3<sup>rd</sup> Ed.). Washington D.C.: CQ Press.
- Baron, J. and Spranca, M. (1997). Protected Values. *Organizational Behavior and Human Decision Processes*, 70(1), 1-16.
- Barr, P. S. (1998). Adapting to Unfamiliar Environmental Events: A Look at The Evolution of Interpretation and its Role in Strategic Change. *Organization Science*, 9(6), 644-669.
- Batie, S. (2008). Wicked Problems and Applied Economics. *American Journal of Agricultural Economics*, 90(5), 1176.
- Baumgartner, F. R. and Jones, B. D. (2009). *Agendas and instability in American politics*. Chicago; London: The University of Chicago Press
- Beacham, C. and Shambaugh, N. (2010). Translating Design Thinking for Scientists. Psychology of Thinking. at: <http://Drneal.Org/Papers-and-Presentations/2009-Psychologyofthinking-D.Pdf>
- Berger, P. L. and Luckmann, T. (1966). *The Social Construction of Reality: a treatise in the sociology of knowledge*. Garden City, N.Y.: Doubleday
- Bhaskar, R. (1986). *Scientific Realism and Human Emancipation*. London: Verso.
- Bhaskar, R. (1991). *Philosophy and the Idea of Freedom*. Oxford: Blackwell.
- Birkland, T. A. (1997). *After Disaster: Agenda Setting, Public Policy, and Focusing Events*. Washington, DC: Georgetown University Press.
- Borko, H., Whitcomb, J., and Liston, D. (2009). Wicked Problems and Other Thoughts on Issues of Technology and Teacher Learning. *Journal of Teacher Education*, 60(1), 3-7.

- Borrone, L. C. (2005). Sparking The Globalized Trade and Transportation Connection - Supplying Freight System Responses to Global Trade Demands. 2005 Thomas B. Deen Distinguished Lecture. *Transportation Research Record: Journal of The Transportation Research Board*, 1906.
- Bos, J., Blok, V., and Van Tulder, R. (2013). From Confrontation to Partnerships: The Role of A Dutch Non-Governmental Organisation in Co-Creating A Market to Address The Issue of Animal Welfare. *International Food and Agribusiness Management Review*, 16(A), 69-75.
- Bostrom, N. and Ord, T. (2006). The Reversal Test: Eliminating Status Quo Bias in Applied Ethics. *Ethics*, 116(4), 656-679.
- Bouma, J., Van Altvorst, A. C., Eweg, R., Smeets, P. and Van Latesteijn, H. (2011). The Role of Knowledge When Studying Innovation and The Associated Wicked Sustainability Problems in Agriculture. *Advances in Agronomy*, 113, 283-312.
- Bouquet, C., and Birkinshaw, J. (2008). Weight Versus Voice: How Foreign Subsidiaries Gain Attention From Corporate Headquarters. *Academy of Management Journal*, 51(3), 577-601.
- Bozeman, B. (1992). Experimental Design in Public Policy and Management Research: Introduction. *Journal of Public Administration Research and Theory*, 2(4), 440-442.
- Bozeman, B. and Scott, P. (1992). Laboratory Experiments in Public Policy and Management. *Journal of Public Administration Research and Theory*, 2(3), 293-313.
- Breunig, C., and Koski, C. (2009). Punctuated Budgets and Governors' Institutional Powers. *American Politics Research*, 37(6), 1116-1138.
- Brown, V. A., Harris, J. A., and Russell, J. Y. (2010). *Tackling Wicked Problems Through The Transdisciplinary Imagination*. Washington, DC: Earthscan.
- Bryman, A. (2006). Integrating Quantitative and Qualitative Research: How Is It Done? *Qualitative Research*, Vol. 6, Pp. 97-113.

- Buchanan, R. (1992). Wicked Problems in Design Thinking. *Design Issues*, 8(2), 5-21.
- Burrell, G. and Morgan, G. (1982). *Sociological Paradigms and Organisational Analysis*. London: Heinemann.
- Butler, C. (2006). Understanding the Coho Crisis: Political Knowledge in a Fractured Salmon Fishery. *MAST*, 4(2), 73-92.
- Buttriss, G. and Wilkinson, I. F. (2014). Using Event Structure Analysis to Analyze a Case of Firm Internationalization. Paper presented at IMP Conference, Kedge Business School, Bordeaux, December 2014.
- Cairney, P. (2012). Complexity Theory in Political Science and Public Policy. *Political Studies Review*, 10(3), 346-358.
- Cairney, P. and Jones, M. D. (2016). Kingdon's Multiple Streams Approach: What Is the Empirical Impact of this Universal Theory? *The Policy Studies Journal*, 44(1), 37-58.
- Cairney, P. and Weible, C. (2015). Comparing and Contrasting Peter Hall's Paradigms and Ideas with the Advocacy Coalition Framework. In Hogan J. and Howlett, M. (eds) *Policy Paradigms in Theory and Practice: Discourses, Ideas and Anomalies in Public Policy Dynamics*, 83-99. London: Palgrave Macmillan.
- Camillus, J. C. (2008). *Strategy as A Wicked Problem*. Boston: Harvard Business School Press.
- Candel, J. (2014). Food security governance: a systematic literature review. *Food Sec.*, 6, 585-601.
- Cavazos, D. E., and Rutherford, M. A. (2011). Examining How Media Coverage Impacts the Regulatory Notice and Comment Process. *The American Review of Public Administration*, 41(6), 625-638.
- Cejudo, G. and Michel, C. (2015). Addressing Fragmented Government Action: Coordination, Coherence, and Integration. Paper presented at the 2nd International Conference in Public Policy, Milan, July 2015.

- Cho, T. S. and Hambrick, D. C. (2006). Attention as the Mediator between Top Management Team Characteristics and Strategic Change: The Case of Airline Deregulation. *Organization Science*, 17(4) 453-469.
- Chong, D. and Druckman, J. N. (2007). Framing Public Opinion in Competitive Democracies. *The American Political Science Review*, 101(4), 637-655.
- Churchman, C. W. (1967). Guest Editorial: Wicked Problems. *Management Science*, 14(4), B141-B142.
- Churchman, C. W., Protzen, J-P. and Webber, M. (2006). In Memoriam: Horst W.J. Rittel. *Design Issues*, 22(4), 18-20.
- Coase, R. H. (1960). The Problem of the Social Cost. *The Journal of Law and Economics*, 3, 1-44.
- Cohen, M. D., March, J. M. and Olsen, J. P. (1972). A Garbage Can Model of Organizational Choice. *Administrative Science Quarterly*, 17(1), 1-25.
- Conklin, J. (2006). *Dialogue Mapping: Building Shared Understanding of Wicked Problems*. Wiley.
- Conklin, J. (2008). Wicked Problems and Social Complexity. Available at: <http://Cognexus.Org/Wpf/Wickedproblems.Pdf>
- Coyne, R. (2005). Wicked Problems Revisited. *Design Studies*, 26(1), 5-17.
- Crane, R. and Landis, J. (2010). Planning for Climate Change: Assessing Progress and Challenges. *Journal of the American Planning Association*, 76(4), 389-401.
- Creswell, J. (2002). *Qualitative, Quantitative, and Mixed Methods Approaches* (2<sup>nd</sup> ed). Thousand Oaks, CA: Sage.

- Cunningham, F., Ranmuthugala, G., Westbrook, J. and Braithwaite, J. (2012). Net Benefits: Assessing The Effectiveness of Clinical Networks in Australia Through Qualitative Methods. *Implementation Science*, 7, 108-120.
- Cuppen, E. (2012). Diversity and Constructive Conflict in Stakeholder Dialogue: Considerations for Design and Methods. *Policy Science*, 45, 23-46.
- Cyert, R. M., and March, J. G. (1963). *A Behavioral Theory of the Firm*. New Jersey: Prentice-Hall.
- Daft, R. L., and Weick, K. E. (1984). Toward A Model of Organizations as Interpretation Systems. *Academy of Management Review*, 9(2), 284-295.
- De Lira, C, Velikovich, A. L., and Wouchuk, J. G. (2011). Analytical Linear Theory for The Interaction of A Planar Shock Wave With A Two- Or Three-Dimensional Random Isotropic Density Field. *Physical Review. E, Statistical, Nonlinear, and Soft Matter Physics*, 83(5 Pt 2), 056320.
- De Lira, C. (2010). Turbulence Generation by a Shock Wave Interacting with a Random Density in Homogeneity Field. *Physica Scripta*, 2010, 014022.
- Dearborn, D. C., and Simon, H. A. (1958). Selective Perception: A Note on the Departmental Identifications of Executives. *Sociometry*, 21(2), 140-144.
- Department of Fisheries and Oceans [DFO] (1992). Speech. Statement by John C. Crosbie, Minister of Fisheries and Oceans. Action Plan in Response to the Report on the Fraser River Salmon Investigation. December 7, 1992. Government of Canada.
- (1993a). News Release. Crosbie Announces Fraser And Skeena River Management Plans For 1993, March 26, 1993. NR-PR-93-13E. DFO, Government of Canada
- (1993b). News Release. Bilateral Agreements to be Negotiated, May 20, 1993. NR-PR-93-26E. Government of Canada.

- (1995). News Release. Tobin Announces Five-Point Action Plan for the 1995 Pacific Salmon Fishery, March 7, 1995. NR-HQ-95-28E. Government of Canada.
- (1997a). Backgrounder. The Pacific Salmon Revitalization Strategy. January 1997. DFO-38522. Government of Canada. Retrieved from [http://www.dfo-mpo.gc.ca/media/backgrou/1997/hq-ac3-3\\_e.htm](http://www.dfo-mpo.gc.ca/media/backgrou/1997/hq-ac3-3_e.htm)
- (1997b). News Release. Mifflin Accepts Panel's Recommendations for B.C. Salmon Fishery, January 9 1997. NR-HQ-9703E. Government of Canada. Retrieved from [http://www.dfo-mpo.gc.ca/media/newsrel/1997/hq-ac03\\_e.htm](http://www.dfo-mpo.gc.ca/media/newsrel/1997/hq-ac03_e.htm)
- (1997c). *Towards a Sustainable Pacific Salmon Fishery. The Federal Response to the Tripartite Panel Report.* Government of Canada.
- (1998a). *A New Direction for Canada's Pacific Salmon Fisheries*, October 1998. Government of Canada.
- (1998b). *An Allocation Policy for Pacific Salmon, 1999-2005. A New Direction: The Second in a Series of Papers from Fisheries and Oceans Canada*, December 1998. Government of Canada.
- (1999). *An Allocation Policy for Pacific Salmon. A New Direction: The Fourth in a Series of Papers from Fisheries and Oceans Canada*, October 1999. Retrieved from <http://www.dfo-mpo.gc.ca/Library/240366.htm>
- Dixon-Woods M., Agarwal, S., Jones, D. et al. (2005). Synthesising qualitative and quantitative evidence: a review of possible methods. *Journal of Health Services Research and Policy*, 10(1), 45-53.
- Dixon-Woods, M., Bonas, S., Booth, A., Jones, D. Et Al. (2006). How Can Systematic Reviews Incorporate Qualitative Research? A Critical Perspective. *Qualitative Research*, 6(1), 27-44.
- Dixon-Woods, M., Shaw, R. L., Agarwal, S. and Smith, J. A. (2004). The Problem of Appraising Qualitative Research. *Qual. Saf. Health Care*, 13, 223-225.

- Dobson, P. (2002). Critical Realism and Information Systems Research: Why Bother With Philosophy? *Information Research*, 7(2). Available at: [Http://Informationr.Net/Ir/7-2/Paper124.Html](http://Informationr.Net/Ir/7-2/Paper124.Html)
- Downs, A. (1972). Up and Down With Ecology-The Issue-Attention Cycle. *Public Interest*, 28, 38-50.
- Druckman, J. N. (2001). Evaluating Framing Effects. *Journal of Economic Psychology*, 22, 91-101.
- Druckman, J. N. and Mcdermott, R. (2008). Emotion and the Framing of Risky Choice. *Polit Behav*, 30, 297-321.
- Dutton, J. (1997). Strategic Agenda Building in Organizations. In Z. Shapira (ed.), *Organizational Decision Making*, 81-107. Cambridge, UK: Cambridge University Press.
- Dutton, J. E. (1986). Understanding Strategic Agenda Building and Its Implications for Managing Change. *Scandinavian Journal of Management Studies*, 3(1), 3-24.
- Dutton, J. E. and Ashford, S. J. (1993). Selling Issues to Top Management. *Academy of Management Review*, 18(3), 397-428.
- Dutton, J. E., Ashford, S., O'Neill, R. M., and Lawrence, K. A. (2001). Moves That Matter: Issue Selling and Organizational Change. *The Academy of Management Journal*, 44(4) 716-736.
- Easterby-Smith, M., Thorpe, R., Jackson, P. and Lowe, A. (2008). *Management Research* (3<sup>rd</sup> ed.). London, UK: Sage.
- EB Experts Inc (1996). *DFO's Response to the Report of the Fraser River Sockeye Public Review Board. Final Report*. Retrieved from <http://www.dfo-mpo.gc.ca/Library/274615.pdf>
- Einstein, A. (1948). A Message to the World Congress of Intellectuals. *Bulletin of Atomic Scientists*, 4(10), 295 and 299.

- Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *Academy of Management Review*, 14(4), 532-550.
- Eisenhardt, K. M. and Graebner, M. E. (2007). Theory Building From Cases: Opportunities and Challenges. *The Academy of Management Journal*, 50(1), 25-32.
- Ellsberg, D. (1961). Risk, Ambiguity, and the Savage Axioms. *The Quarterly Journal of Economics*, 75(4), 643-669.
- EPPI-Centre (2010). *Methods for Conducting Systematic Reviews*. Retrieved from <https://eppi.ioe.ac.uk/cms/Default.aspx?tabid=88>
- Everingham, J. (2012). Towards Social Sustainability of Mining. The Contribution of New Directions in Impact Assessment and Local Governance. *Greener Management International*, 57, 91-103.
- Fatas, E., Neugebauer, T. and Tamborero, P. (2007). How Politicians Make Decisions: A Political Choice Experiment. *Journal of Economics*, 92(2), 167-196.
- Ferreira, L. C. (2011). Attention process: A multilevel perspective. Insper Working Paper WPE: 261/2011. Instituto de Ensino e Pesquisa (Insper). Retrieved from [https://www.insper.edu.br/en/wp-content/uploads/2013/12/2011\\_wpe261.pdf](https://www.insper.edu.br/en/wp-content/uploads/2013/12/2011_wpe261.pdf)
- Fitz Gibbon, J. and Mensah, K. (2012). Climate Change as a Wicked Problem: An Evaluation of the Institutional Context for Rural Water Management in Ghana. *Sage Open*, April-June 2012, 1-14.
- Flanagan, J. C. (1954). The Critical Incident Technique. *Psychological Bulletin*, 51(4), 327-358.
- Foss, K. and Foss, N. J. (2005). Simon on problem solving: Implications for new organisational forms. SMG Working Paper No. 8/2005, Center for Strategic Management and Globalization Copenhagen Business School.

- Frame, B. (2008). 'Wicked', 'Messy', and 'Clumsy': Long-Term Frameworks for Sustainability. *Environment and Planning C: Government and Policy*, 26, 1113-1128.
- Fraser River Sockeye Public Review Board [FRSPRB] (1995). *Fraser River Sockeye 1994. Problems & Discrepancies*. Public Works and Government Services Canada.
- Frey, B. and Eichenberger, R. (1989). *Public Choice*, 68, 71-89.
- Galbraith, J. R. (1974). Organization design: An information processing view. *Interfaces*, 4(3), 28-36.
- Gill, J. and Johnson, P. (2002). *Research Methods for Managers* (3<sup>rd</sup> ed.). London: Sage.
- Gilmore, W. S., and Camillus, J. C. (1996). Do Your Planning Processes Meet the Reality Test? *Long Range Planning*, 29(6), 869-879.
- Givens, L. M. (2017). It's a New Year...So Let's Stop the Paradigm Wars. *International Journal of Qualitative Methods*, 16, 1-2.
- Gollagher, M. and Hartz-Karp, J. (2013). The Role of Deliberative Collaborative Governance in Achieving Sustainable Cities. *Sustainability*, 5, 2342-2366.
- Gough, D. (2013). Meta-Narrative and Realist Reviews: Guidance, Rules, Publication Standards and Quality Appraisal. *BMC Medicine*, 11, 22-24.
- Gough, D., Oliver, S. and Thomas, J. (2013). *Learning from Research: Systematic Reviews for Informing Policy Decisions. A Quick Guide*. A Paper for the Alliance for Useful Evidence. London: Nesta.
- Gray, M. and Gill, R. (2009). Tackling "Wicked" Problems Holistically With Institutional Policymaking. In T. Natarajan et al. (eds.), *Institutional Analysis and Praxis*, pp. 87-102. Springer Science+Business Media.
- Greenhalg, T., Robert, G., Macfarlane, F. et al. (2005). Storylines of research in diffusion of innovation: a meta-narrative approach to systematic review. *Social Science and Medicine*, 61, 417-430.

- Greve, H. R. (2008). A Behavioral Theory of Firm Growth: Sequential Attention to Size and Performance Goals. *The Academy of Management Journal*, 51(3) 476-494.
- Griffin, L. J. (1993). Narrative, Event-Structure Analysis and Causal Interpretation in Historical Sociology. *American Journal of Sociology*, 98, 1094-1133.
- Griffin, L. J. and Kostard, R. R. (1993). Historical Inference and Event-Structure Analysis. *International Review of Social History*, 43(S6), 145-165.
- Grimmelikhuijsen, S., Jilke, S., Olsen, A.M., Tummers, L. (2017). Behavioral Public Administration: Combining Insights from Public Administration and Psychology. *Public Administration Review*, 77(1), 45-56.
- Grint, K. (2008). Wicked Problems and Clumsy Solutions: The Role of Leadership. *Clinical Leader*, 1(2), 11-25.
- Haas, M. R., and Hansen, M. T. (2001). Competing for Attention in Knowledge Markets: Electronic Document Dissemination in a Management Consulting Company. *Administrative Science Quarterly*, 46(1), 1-28.
- Hager, M. (1998). Event Structure Analysis as A Tool for Understanding Organizational Life Histories. Prepared for Presentation at The 1998 Annual Meetings of The Association for Research On Nonprofit Organizations and Voluntary Action, November 5-7, Seattle, Washington.
- Hamilton, H. (2013). Sustainable Food Lab Learning Systems for Inclusive Business Models Worldwide. *International Food and Agribusiness Management Review*, 16(A), 33-37.
- Hatchuel, A., Le Masson, P., and Weil, B. (2011). Teaching Innovative Design Reasoning: How Concept-Knowledge Theory Can Help Overcome Fixation Effects. *Ai Edam*, 25(1), 77-92.
- Head, B. (2010). *Wicked Problems in Water Governance: Paradigm Changes to Promote Water Sustainability and Address Planning Uncertainty*. Urban Water Security Research Alliance Technical Report No. 38.

- Head, B., and Alford, J. (2008). Wicked Problems: The Implications for Public Management. Prepared for Presentation at The International Research Society for Public Management 12<sup>th</sup> annual Conference, 26-28 March, Brisbane.
- Heise D. (2012). Event Structure Analysis. A Short Ethno Tutorial. Available at: <http://www.indiana.edu/~socpsy/ESA/tutorial.html>. Last Updated June 21, 2012.
- Heise, D. (1989). Modeling Event Structures. *The Journal of Mathematical Sociology*, 14(2-3), 139-169.
- Heise, D. (1991). Event Structure Analysis: A Qualitative Model of Quantitative Research. In N. G. Fielding and R. M. Lee (eds.), *Using Computers in Qualitative Research*. London; Newbury Park: Sage.
- Heise, D. and Durig, A. (1997). A Frame for Organizational Actions and Macroactions. *The Journal of Mathematical Sociology*, 22(2), 95-123.
- Hendricks, W. (1972). The structural study of narration: Sample analyses. *Poetics*, 3, 100-123.
- Herrick, C. and Pratt, J. (2012). Sustainability in the Water Sector: Enabling Lasting Change through Leadership and Cultural Transformation. *Nature and Culture*, 7(3), 285-313.
- Hilson, C. (2013). It's All About Climate Change, Stupid! Exploring the Relationship Between Environmental Law and Climate Law. *Journal of Environmental Law*, 25(3), 359-370.
- Hoffman, A. J., and Devereaux Jennings, P. (2011). The BP Oil Spill as a Cultural Anomaly? Institutional Context, Conflict, and Change. *Journal of Management Inquiry*, 20(2), 100-112.
- Hoffman, A. J., and Ocasio, W. (2001). Not All Events Are Attended Equally: Toward Middle-Range Theory of Industry Attention to External Events. *Organization Science*, 12(4), 414-434.

- Holman, N. (2013). Effective Strategy Implementation: Why Partnership Interconnectivity Matters. *Environment and Planning C: Government and Policy*, 31, 82-101.
- Holmwood, J. (2005). Functionalism and its Critics. In A. Harrington (ed.), *Modern Social Theory: An Introduction*, 87-110. Oxford: Oxford University Press.
- Horiuchi, C. (2007). One Policy Makes No Difference? *Administrative Theory and Praxis*, 29(3), 432-449.
- Horn, R. E. (2005). Connecting the Smudges--How Analytic Info-Murals May be of Help in Dealing with Social Messes. Available at <http://web.stanford.edu/~rhorn/a/recent/ConnectSmudgesPaperIntro.html>
- Horn, R. E. and Webber, R. (2007). *New Tools for Resolving Wicked Problems: Mess Mapping and Resolution Mapping Processes*. MacroVU(r), Inc. and Strategy Kinetics, LLC.
- Hospes, O., Van Der Valk, O. and Van Der Mheen-Sluijer, J. (2012). Parallel Development of Five Partnerships to Promote Sustainable Soy in Brazil: Solution or Part of Wicked Problems? *International Food and Agribusiness Management Review*, 15(B), 39-62.
- Howlett, M., McConnell, A. and Perl, A. (2014). Streams and stages: Reconciling Kingdon and policy process theory. *European Journal of Political Research*, 54(3), 1-16.
- Hudson, R., Comer, L., and Whichello, R. (2014). Transitions in a Wicked Environment. *Journal of Nursing Management*, 22(2), 201-210.
- Hughes, T., Huang, H. and Young, M. (2013). The Wicked Problem of China's Disappearing Coral Reefs. *Conservation Biology*, 27(2), 261-269.
- Humphreys, J. S., Kuipers, P., Wakerman, J. et al. (2009). How far can systematic reviews inform policy development for "wicked" rural health service problems? *Australian Health Review November*, 33(4), 592-600.

- Hussenot, A. and Missonier, S. (2015). Encompassing Stability and Novelty in Organization Studies: An Events-based Approach. *Organization Studies*, 37(4), 523-546.
- Isabella, L. A. (1990). Evolving Interpretations as A Change Unfolds: How Managers Construe Key Organizational Events. *The Academy of Management Journal*, 33(1), 7-41.
- Jakubowicz, A. (2011). Playing the triangle: Cosmopolitanism, Cultural Capital and Social Capital as intersecting scholarly discourses about social inclusion and marginalisation in Australian public policy debates. *Cosmopolitan Civil Societies Journal*, 3(3), 68-91.
- James, O., Jilke, S., and Van Ryzin, G. G. (2017). Behavioural and Experimental Public Administration: Emerging Contributions and New Directions. *Public Administration*, 95, 865-873.
- Jarzombek, M. (2006). Sustainability: Fuzzy Systems and Wicked Problems. *Log*, 8, 7-12.
- Jenner, M., Barnes, J. and James, S. (2013). Learning by leading Using organisation transformation to develop leadership capacity in East Thames Group. *The International Journal of Leadership in Public Services*, 9(3/4), 116-124.
- Jentoft, S., and Chuenpagdee, R. (2009). Fisheries and Coastal Governance as a Wicked Problem. *Marine Policy*, 33(4), 553-560.
- Jha, S., and Lexa, F. (2014). Wicked Problems. *Journal of the American College of Radiology*, 11, 437-439.
- John, P. and Margetts, H. (2003). Policy Punctuations in the UK: Fluctuations and Equilibria in Central Government Expenditure since 1951. *Public Administration*, 81(3), 411-432.
- Jones, B. D. and Baumgartner, F. R. (2005). *The Politics of Attention: How Government Prioritizes Problems*. London: University of Chicago Press.

- Jones, M.D. and Jenkins-Smith, H.C. (2009). Trans-Subsystem Dynamics: Policy Topography, Mass Opinion, and Policy Change. *The Policy Studies Journal*, 37(1), 37-58.
- Kahneman D., and Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, 47(2), 263-292.
- Kahneman, D. (1973). *Attention and Effort*. Englewood Cliffs, N.J: Prentice-Hall.
- Kahneman, D., Knetsch, J. L., and Thaler, R. (1986). Fairness as a Constraint On Profit Seeking: Entitlements in The Market. *The American Economic Review*, 76(4), 728-741.
- Kameniar, B. M., Imtoul, A. and Bradley, D. (2010). "Mullin' the Yarndi" and Other Wicked Problems at a Multiracial Early Childhood Education Site in Regional Australia. *Educational Policy*, 24(1), 9-27.
- Kastenhofer, K. (2011). Risk Assessment of Emerging Technologies and Post-Normal Science. *Science, Technology & Human Values*, 36(3), 307-333.
- Kazdin, A. E. (2011). Conceptualizing the Challenge of Reducing Interpersonal Violence. *Psychology of Violence*, 1(3), 166-187.
- Kemp, K. A. (1984). Accidents, Scandals, and Political Support for Regulatory Agencies. *The Journal of Politics*, 46(2), 401-427.
- Kethrapal, N. (2010). Load Theory of Selective Attention and The Role of Perceptual Load: Is It Time for Revision? *European Journal of Cognitive Psychology*, 22(1), 149-156.
- Khan, A. and Neis, B. (2010). The Rebuilding Imperative in Fisheries: Clumsy Solutions for a Wicked Problem? *Progress in Oceanography*, 87, 347-356.
- Kingdon, J. W. (1984) *Agendas, Alternatives, and Public Policies*. New York: Harper Collins College Publishers.

- Kirk, J. and Miller, M. L. (1986). *Reliability and Validity in Qualitative Research*. Beverly Hills, CA: Sage.
- Kirzinger, A., Di Julio, B., Hamel, L. et al. (2017). Kaiser Health Tracking Poll - June 2017: ACA, Replacement Plan, and Medicaid. Available at: <http://www.kff.org/health-reform/poll-finding/kaiser-health-tracking-poll-june-2017-aca-replacement-plan-and-medicaid/>
- Kreuter, M. W., De Rosa, C., Howze, E. H. and Baldwin, G. T. (2004). Understanding Wicked Problems: A Key to Advancing Environmental Health Promotion. *Health Education and Behavior*, 31(4), 441-454.
- Kuehnhanss, C. R., Heyndels, B. and Hilken, K. (2015). Choice in Politics: Equivalency Framing in Economic Policy Decisions and the Influence of Expertise. *European Journal of Political Economy*, 40, 360-374.
- Kunz, W. and Rittel, H. (1972). Information Science: On the Structure of Its Problems. *Inform. Stor. Rev*, 8, 95-98.
- Labeledz, C. S., Cavaleri, S. A. and Berry, G. R. (2011). Interactive Knowledge Management: Putting Pragmatic Policy Planning in Place. *Journal of Knowledge Management*, 15(4), 551-567.
- Lagadec, P. (2009). A New Cosmology of Risks and Crises: Time for a Radical Shift in Paradigm and Practice. *Review of Policy Research*, 26(4), 473-86.
- Layder, D. (1993). *New Strategies in Social Research: An Introduction and Guide*. Cambridge: Polity Press
- Lazarus, R. J. (2010). Super Wicked Problems and Climate Change: Restraining the Present to Liberate the Future. *Environmental Law and Policy Annual Review*, 8, 10749-10756.
- Leboeuf, R. A. and Shafir, E. (2003). Deep Thoughts and Shallow Frames: On the Susceptibility to Framing Effects. *Journal of Behavioral Decision Making*, 16, 77-92.

- Lecy, J. D., Mergel, I. A. and Schmitz, H. P. (2014). Networks in Public Administration: Current scholarship in review. *Public Management Review*, 16(5), 643-66.
- Ledgerwood, A. and Boydston, A. (2014). Sticky Prospects: Loss Frames Are Cognitively Stickier Than Gain Frames. *Journal of Experimental Psychology: General*, 143(1), 376-385.
- Lee, K. N. (1993). *Compass and Gyroscope. Integrating Science and Politics for the Environment*. Washington D.C.: Island Press.
- Lee, S. and Park, H. S. (2011). Effects of Message Framing and Anchoring On Reaching Public Consensus on the Korea-U.S. FTA Issue. *Communication Research*, 40(2), 176-192.
- Leonard-Barton, D. (1990). A Dual Methodology for Case Studies: Synergistic Use of a Longitudinal Single Site with Replicated Multiple Sites. *Organization Science*, 1(3), Special Issue: Longitudinal Field Research Methods for Studying Processes of Organizational Change, 248-266.
- Levin, I.P., Schneider, S.L. and Gaeth, G. (1998). All Frames Are Not Created Equal: A Typology and Critical Analysis of Framing Effects. *Organizational Behavior and Human Decision Processes*, 76(2), 149-188.
- Levin, K., Cashore, B., Bernstein, S. and Auld, G. (2010). Playing it Forward: Path Dependency, Progressive Incrementalism, and the “Super Wicked” Problem of Global Climate Change. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.464.5287&rep=rep1&type=pdf>
- Levinthal, D., C. Rerup. 2006. Crossing an Apparent Chasm: Bridging Mindful and Less-Mindful Perspectives on Organizational Learning. *Organization Science*, 17(4), 502-513.
- Levy, J. (2003). Applications of Prospect Theory to Political Science. *Synthese*, 135, 215-241.

- Lincoln, Y. S. and Guba, E. G. (1985). *Naturalistic Inquiry*. Beverly Hill, CA: Sage.
- Lindblom, Charles E. (1984), *The policy-making process* (2<sup>nd</sup> ed.). Englewood Cliffs, New Jersey: Prentice-Hall.
- Linde, J. and Vis, B. (2015). Do Politicians Take Risky Decisions Similar to the Rest of Us? An Experimental Test of Prospect Theory among Politicians. *Paper to be presented at the 73<sup>rd</sup> annual MPSA conference April 16-19, 2015, Chicago*. Retrieved from [http://www.highriskpolitics.org/MPSA\\_Linde\\_Vis\\_final.pdf](http://www.highriskpolitics.org/MPSA_Linde_Vis_final.pdf)
- Logue, D. (2009). Moving Policy Forward: 'Brain Drain' as a Wicked Problem. *Globalisation, Societies and Education*, 7(1), 41-50.
- Lorenzoni, I., Jones, M. and Turnpenny, J. R. (2007). Climate change, human genetics, and post-normality in the UK. *Futures*, 39, 65-82.
- Loukis, E., Xenakis, A. and Tseperli, N. (2009). Using Argument Visualization to Enhance e-Participation in the Legislation Formation Process. In A. Macintosh and E. Tambouris (eds.), *ePart 2009*, 125-138. Berlin: Springer-Verlag.
- Macionis, J. and Gerber, L. M. (2010). *Sociology* (7<sup>th</sup> ed.). Toronto: Pearson Prentice Hall.
- McKean, M. A. 2000. Common property: What is it, what is it good for, and what makes it work. In C. Gibson, M. McKean, & E. Ostrom (eds.), *People and forests: Communities, institutions, and governance*, 27-55. Cambridge, MA: MIT Press.
- Maitlis, S., and Sonenshein, S. (2010). Sensemaking in Crisis and Change: Inspiration and Insights From Weick (1988). *Journal of Management Studies*, 47(3), 551-580.
- March, J. G. (1994). *A Primer on Decision Making*. New York: Free Press.
- March, J. G. (1997). Understanding How Decision Happen in Organizations. In Z. Shapira (ed.), *Organizational Decision Making*, 9-34. Cambridge, UK: Cambridge University Press.

- March, J. G. (2008). *Explorations in Organizations*. Stanford, Calif.: Stanford Business Books.
- March, J. G. and Olsen, J. P. (1976). *Ambiguity and Choice in Organizations*. Bergen, Norway: Universitetsforlaget.
- March, J. G. and Simon, H. A. (1958). *Organizations*. New York: John Wiley and Sons, Inc.
- March, J. G., Shapira, Z. (1992). Variable Risk Preference and the Focus of Attention. *Psychol. Rev.*, 99(1) 172-183.
- Martin, G., Gollan, P. J., and Grigg, K. (2011). Is There A Bigger and Better Future for Employer Branding? Facing Up to Innovation, Corporate Reputations and Wicked Problems in SHRM. *The International Journal of Human Resource Management*, 22(17), 3618-3637.
- Mascarenhas, O. (2009). Innovation as Defining and Resolving Wicked Problems. ENT 470/570 - 2009 - 02. Available at <https://www.scoop.int/t/wicked-problems-defined-and-solved-how/p/3825735864/2012/12/22/innovation-as-defining-and-resolving-wicked-problems-ozzie-mascarenhas-university-of-detroit>
- Matkin, J.G. (1997). Working Towards More Certainty and Stability. Fact Finding Review of the AFS Pilot Salmon Sales Program. Department of Fisheries and Oceans, Government of Canada.
- May, A. W. (1996). *Altering Course. A Report to the Minister of Fisheries and Oceans on Intersectoral Allocations of Salmon in British Columbia*. Department of Fisheries and Oceans, Government of Canada.
- May, P. J., Sapotichne, J. and Workman, S. (2009). Widespread Policy Disruption: Terrorism, Public Risks, and Homeland Security. *The Policy Studies Journal*, 37(2), 171-94.
- May, P. J., Workman, S., and Jones, B. D. (2008). Organizing Attention: Responses of the Bureaucracy to Agenda Disruption. *Journal of Public Administration Research and Theory*, 18(4), 517-541.

- McLean, M. R. (2013). Allocating Resources--A Wicked Problem. *Health Progress (Saint Louis, Mo.)*, 94(6), 60.
- Mercer, J. (2005). Prospect Theory and Political Science. *Annu. Rev. Polit. Sci.*, 8, 1-21.
- Merton, R. (1957). *Social Theory and Social Structure*. New York: Free Press.
- Meyer, A. D. (1982). Adapting to Environmental Jolts. *Administrative Science Quarterly*, 27(4), 515-537.
- Miles, M. and Huberman, M. (1994). *Qualitative Data Analysis*. Thousand Oaks, CA: Sage.
- Milfont, T. and Duckitt, J. (2010). The Environmental Attitudes Inventory: A Valid and Reliable Measure to Assess the Structure of Environmental Attitudes. *Journal of Environmental Psychology*, 30, 80-94.
- Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Med*, 6(6): e1000097.
- Molina-Azorin, J.F., Bergh, D.D., Corley, K.G., and Ketchen, D.J. (2017). Mixed Methods in The Organizational Sciences: Taking Stock and Moving Forward. *Organizational Research Methods*, 20(2) 179-192.
- Morgan, G. (1997). *Images of Organization* (2<sup>nd</sup> ed.). Thousand Oaks, CA: Sage.
- Mortensen, P. B. (2005). Policy Punctuations in Danish Local Budgeting. *Public Administration*, 83(4), 931-950.
- Munneke, L., Andriessen, J., Kanselaar, G., and Kirschner, P. (2007). Supporting Interactive Argumentation: Influence of Representational Tools on Discussing A Wicked Problem. *Computers in Human Behavior*, 23(3), 1072-1088.

- Muse, B. (1999). Fleet Reduction in British Columbia's Commercial Salmon Fisheries: 1996-1998. Alaska Commercial Fisheries Entry Commission. Available at [https://www.cfec.state.ak.us/RESEARCH/buyback/BC\\_BB\\_2.PDF](https://www.cfec.state.ak.us/RESEARCH/buyback/BC_BB_2.PDF)
- Muse, B. (1999). *Fleet Reduction in British Columbia's Commercial Salmon Fisheries: 1996-1998*. Alaska Commercial Fisheries Entry Commission.
- Nabi, R. L. (2003). Exploring the Framing Effects of Emotion. Do Discrete Emotions Differentially Influence Information Accessibility, Information Seeking, and Policy Preference? *Communication Research*, 30(2), 224-247.
- Newell, A. and Simon, H. A. (1972). *Human problem solving*. New Jersey: Prentice-Hall.
- Nigam, A., and Ocasio, W. (2010). Event Attention, Environmental Sensemaking, and Change in Institutional Logics: An Inductive Analysis of the Effects of Public Attention to Clinton's Health Care Reform Initiative. *Organization Science*, 21(4), 823-841.
- Norman, J. (2017). Affordable Care Act Gains Majority Approval for First Time. Available at: <http://www.gallup.com/poll/207671/affordable-care-act-gains-majority-approval-first-time.aspx>
- Norris, C. (1999). The New Realism. Bhaskar Interview. *The Philosophers' Magazine*, 8, 48-50.
- Norton, B. G. (2005). *Sustainability. A Philosophy of Adaptive Ecosystem Management*. Chicago: The University of Chicago Press.
- Norton, B. G. (2012). The Ways of Wickedness: Analyzing Messiness with Messy Tools. *Journal of Agricultural and Environmental Ethics*, 25(4), 447-465.
- Ocasio, W. (1997). Towards An Attention-Based View of the Firm. *Strategic Management Journal*, 18(Summer Special Issue), 187-206.
- Ocasio, W. (2011). Attention to Attention. *Organization Science*, 22(5), 1286-1296.

- Ocasio, W., Joseph, J. (2008). Rise and Fall—Or Transformation? The Evolution of Strategic Planning at the General Electric Company, 1940-2006. *Long Range Planning*, 41(3) 248-272.
- Ostrom, E. (2000). Private and Common Property Rights. *Encyclopedia of Law and Economics, Vol. II: Civil Law and Economics*, 332-379. Ghent, Belgium: University of Ghent.
- Ostrom, E. (2009). A General Framework for Analyzing Sustainability of Social-Ecological Systems. *Science*, New Series, 325(5939), 419-422.
- Ozerol, G., Bresser, H. and Coenen, F. (2012). Irrigated Agriculture and Environmental Sustainability: An Alignment Perspective. *Environmental Science and Policy*, 23, 57-67.
- Pacific Fisheries Resource Conservation Council [PFRCC] (1999). *1998-1999 Annual Report*, June 1999. PFRCC. Retrieved from [https://www.psf.ca/sites/default/files/1998-1999AnnualReport\\_1999\\_0\\_Complete.pdf](https://www.psf.ca/sites/default/files/1998-1999AnnualReport_1999_0_Complete.pdf)
- Pacific Policy Round Table [PPRT] (1995). *Report to the Minister of Fisheries and Oceans on the Renewal of the Commercial Pacific Salmon Fishery*. AHO-21230. Department of Fisheries and Oceans, Government of Canada
- Pacific Salmon Revitalization Plan Review Panel [PSRPRP], (1997) *Tangled Lines. A Federal-Provincial Review of the Mifflin Plan. Restructuring in the Pacific Salmon Fishery*. Department of Fisheries and Oceans, Government of Canada. Retrieved from <http://www.dfo-mpo.gc.ca/Library/199880.pdf>
- Paterson, B.L., Thorne, S. and Dewis, M. (1998). Adapting to and Managing Diabetes. *Image: Journal of Nursing Science*, 130, 57-62.
- Patton, M.Q. (2002). *Qualitative Research and Evaluation Methods* (3<sup>rd</sup> ed). Thousand Oaks, CA: Sage.
- Pearse, P.H. and Larkin, P.A. (1992). *Managing Salmon in the Fraser. Report to the Minister of Fisheries and Oceans on the Fraser River Salmon Investigation*. AHO-16392. Department of Fisheries and Oceans, Government of Canada.

- Peery, N. S. (1972). General Systems Theory: An Inquiry into its Social Philosophy. *The Academy of Management Journal*, 15(4), 495-510.
- Pentland, B. T. (1999). Building Process Theory With Narrative: From Description to Explanation. *The Academy of Management Review*, 24(4), 711-724.
- Pentland, B. T. (2003). Conceptualizing and Measuring Variety in the Execution of Organizational Work Processes. *Management Science*, 49(7), 857-870
- Pentland, B. T., and Feldman, M. S. (2007). Narrative Networks: Patterns of Technology and Organization. *Organization Science*, 18(5), 781-795.
- Periyakoil, V. S. (2007). Taming Wicked Problems in Modern Health Care Systems. *Journal of Palliative Medicine*, 10(3), 658-659.
- Peters, B. G., and Hogwood, B. W. (1985). In Search of the Issue-Attention Cycle. *The Journal of Politics*, 47(1), 238-253.
- Peterson, H. C. (2013). Fundamental Principles of Managing Multi-Stakeholder Engagement. *International Food and Agribusiness Management Review*, 16(A), 11-22.
- Peterson, M. F. (1998). Embedded Organizational Events: The Units of Process in Organization Science. *Organization Science*, 9(1), 16-33.
- Peterson, M. F. (1998). Embedded Organizational Events: The Units of Process in Organization Science. *Organization Science*, 9(1), 16-33.
- Pettigrew, A. M. (1990). Longitudinal Field Research on Change: Theory and Practice. *Organization Science*, 1(3), 267-292.
- Pielke, R., Jr. (2007). *The honest broker: Making sense of science in policy and politics*. Cambridge, MA: Cambridge University Press.

- Pieters, R.; Glöckner, H.H.; Omta, S.W.F. and Weijers, S. (2012). Dutch Logistics Service Providers and Sustainable Physical Distribution: Searching for Focus. *International Food and Agribusiness Management Review*, 15(B), 107-126.
- Ponti, M., (2010). *Actors in Collaboration. Sociotechnical Influence on Practice-Research Collaboration*. Doctoral Dissertation, University of Gothenburg.
- Ponti, M., (2012). Uncovering Causality in Narratives of Collaboration: Actor-Network Theory and Event Structure Analysis. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, 13(1), Art. 11. Available at: [Http://Nbn-Resolving.De/Urn:Nbn:De:0114-Fqs1201117](http://Nbn-Resolving.De/Urn:Nbn:De:0114-Fqs1201117)
- Pries-Heje, J. and Baskerville, R. (2008). The Design Theory Nexus. *MIS Quarterly*, 32(4), 731-755.
- Pump, B. (2011). Beyond Metaphors: New Research on Agendas in the Policy Process. *Policy Studies Journal*, 39, 1-12.
- Quattrone, G. A., and Tversky, A. (1988). Contrasting Rational and Psychological Analyses of Political Choice. *The American Political Science Review*, 82(3), 719-736.
- Raadschelders, J. (2011). The Future of the Study of Public Administration: Embedding Research Object and Methodology in Epistemology and Ontology. *Public Administration Review*, 71(6), 916-924.
- Rayner, S. (2006). *Wicked Problems: Clumsy Solutions - Diagnoses and Prescriptions for Environmental Ills*. Jack Beale Memorial Lecture on Global Environment, ANSW Sydney, Australia, July 2006.
- Remenyi, D., Williams, B., Money, A. and Swartz, E. (1998). *Doing Research in Business and Management: An Introduction to Process and Method*. London: Sage.
- Rerup, C. (2009). Attentional Triangulation: Learning From Unexpected Rare Crises. *Organization Science*, 20(5), 876-893.

- Rith, C. and Dubberly, H. (2006a). Why Horst W.J. Rittel Matters. *Design Issues*, 22(4), 1-3.
- Rith, C. and Dubberly, H. (2006b). Horst W.J. Rittel's Writings on Design: Select Annotations. *Design Issues*, 22(4), 4-17.
- Rittel, H. (1972). On The Planning Crisis: Systems Analysis of the 'First and Second Generations'. *Bedriftsokonomien*, 8, 390-396.
- Rittel, H. and Webber, M. M. (1973). Dilemmas in A General Theory of Planning. *Policy Sciences*, 4(2), 155-169.
- Roaf, S., Nicol, F., and De Dear, R. (2013). The Wicked Problem of Designing for Comfort in a Rapidly Changing World. *Architectural Science Review*, 56(1), 1-3.
- Roberts, N. (2000). Wicked Problems and Network Approaches to Resolution. *International Public Management Review*, 1(1), 1-19.
- Robson, C. (2002). *Real World Research* (2<sup>nd</sup> ed.). Oxford: Balckwell.
- Romme, A.G.L and van Witteloostuijn, A. (1999). Circular organizing and triple loop learning. *Journal of Organizational Change Management*, 12 (5), 439-454.
- Ryan, S. and Neumann, R. (2013). Interdisciplinarity in an Era of New Public Management: A Case Study of Graduate Business Schools. *Studies in Higher Education*, 38(2), 192-206.
- Sabatier, P.A., and Jenkins-Smith, H. (1999). The Advocacy Coalition Framework: An Assessment. In P.A. Sabatier (ed.), *Theories of the Policy Process*, 117-166. Boulder, CO: Westview Press.
- Sadowski, J., Seager, T. P., Selinger, E., Spierre, S. G., and Whyte, K. P. (2013). An Experiential, Game-Theoretic Pedagogy for Sustainability Ethics. *Science and Engineering Ethics*, 19(3), 1323-1339.

- Samuelson, W. and Zeckhauser, R. (1988). Status Quo Bias in Decision Making. *Journal of Risk and Uncertainty*, 1(1), 7-59.
- Sandström, A. (2010). Institutional and Substantial Uncertainty—Explaining The Lack of Adaptability in Fish Stocking Policy. *Marine Policy*, 34, 1357-1365.
- Saunders, M., Lewis, P. and Thornhill, A. (2009). *Research Methods for Business Students* (5<sup>th</sup> Ed). Prentice Hall.
- Savage, L. J. (1954). *The Foundations of Statistics*. New York: Wiley.
- Scherrer, P. and Doohan, K. (2014). Taming Wicked Problems: Towards A Resolution of Tourism Access to Traditional Owner Lands in The Kimberley Region, Australia. *Journal of Sustainable Tourism*, 22(7), 1003-1022.
- Schmitt, R. (2010). Dealing with Wicked Issues: Open Strategizing and the Camisea Case. *Journal of Business Ethics*, 96, 11-19.
- Schreiber, R., Crooks, D. and Stern, P.N. (1997). Qualitative Meta-analysis. In J.M. Morse (ed.), *Completing a Qualitative Project: Details and Dialogue*, pp. 311-326. Thousand Oaks, CA: Sage.
- Scott, J. C. (2006). The Politics of Attention: How Government Prioritizes Problems (Review). *Social Forces*, 85(2), 1042-1043.
- Seager, T., Selinger, E., and Wiek, A. (2012). Sustainable Engineering Science for Resolving Wicked Problems. *Journal of Agricultural and Environmental Ethics*, 25(4), 467-484.
- Segrave, A., Büscher, C. and Frijns, J. (2012). Participatory Futures Research and Social Learning for Integrated Watershed Management. In V. Lagutov (ed.), *Environmental Security in Watersheds: The Sea of Azov*. Springer Science+Business Media B.V.
- Shafir, E. (1993). Choosing Versus Rejecting: Why Some Options Are both Better and Worse than Others. *Memory and Cognition*, 21(4), 546-556.

Shafir, E., Simonson, I. and Tversky, A. (1993). Reason-Based Choice. *Cognition*, 49, 11-36.

Shaw, M. and Crowther, J. (2017). *Community Engagement. A Critical Guide for Practitioners*. Available at: <https://www.rri-tools.eu/-/Community-Engagement-A-Critical-Guide-for-Practitioners>

Simon, H. A. (1947). *Administrative Behavior: A Study of Decision Making Processes in Administrative Organizations*. Chicago: Macmillan.

Simon, H. A. (1955). A Behavioral Theory of Rational Choice. *Quarterly Journal of Economics*, 69, 99-118.

Simon, H. A. (1968). *The Science of the Artificial*. MIT Press: Cambridge.

Simon, H. A. (1971). Designing Organizations for an Information Rich World. In Martin Greenberger (ed.), *Computers, Communication and the Public Interest*. Baltimore: John Hopkins Press.

Simon, H. A. (1973). The Structure of Ill-Structured Problems. *Artificial Intelligence*, 4, 181-201.

Sminia, H. (2009). Process Research in Strategy Formation: Theory, Methodology and Relevance. *International Journal of Management Reviews*, 11(1), 97-125.

Sprout, P. (1997). Management Issues and Quotas in the salmon fishery of british Columbia. Fraser Institue. Retrieved from <https://www.fraserinstitute.org/sites/default/files/FishorCutBaitManagementIssues.pdf>

Stevenson, W. B. and Greenberg, D. N. (1998). The Formal Analysis of Narratives of Organizational Change. *Journal of Management*, 24(6), 741-762.

Stevenson, W. B., and Greenberg, D. N. (2000). Agency and Social Networks: Strategies of Action in a Social Structure of Position, Opposition, and Opportunity. *Administrative Science Quarterly*, 45(4), 651-678.

- Stryker, R. (1996). Beyond History Versus Theory: Strategic Narrative and Sociological Explanation. *Sociological Methods and Research*, 24(3), 304-352.
- Sullivan, B. N. (2010). Competition and Beyond: Problems and Attention Allocation in the Organizational Rulemaking Process. *Organization Science*, 21(2), 432-450.
- Sutcliffe, K. M. and Weick, K. E. (2008). Information Overload Revisited. In G.P. Hodgkinson and W.H. Starbuck (eds.), *The Oxford Handbook of Organizational Decision Making*. Oxford: Oxford University Press.
- Tanner, C. and Medin, D. L. (2004). Protected Values: No Omission Bias and No Framing Effects. *Psychonomic Bulletin and Review*, 11(1), 185-191.
- Tanner, C., Medin, D. L. and Iliev, R. (2008). Influence of Deontological Versus Consequentialist Orientations on Act Choices and Framing Effects: When Principles Are More Important than Consequences. *European Journal of Social Psychology*, 38, 757-769.
- Tashakkori, A. and Teddlie, C. (1998) *Mixed Methodology: Combining Qualitative and Quantitative Approaches*. Thousand Oaks, CA: Sage.
- Thayer, F. (1972). General System(S) Theory: The Promise That Could Not Be Kept. *The Academy of Management Journal*, 15(4), 481-493.
- The Canadian Encyclopedia (2017). Fraser River, article by B.J. Lewis Robinson (March 13, 2007), last edited by Newton (January 31, 2017). Retrieved from <http://www.thecanadianencyclopedia.ca/en/article/fraser-river/>
- The Globe and Mail (Sept. 1, 1992). Salmon shortage brings strife to B.C. fishery stormy waters dwindling stocks of sockeyes appearing at their spawning grounds pit the commercial fishing industry against British Columbia natives.
- (Sept. 16, 1992). B.C. fishermen enter harbours to press for salmon inquiry.
- (Oct. 6, 1992). Government investigating reports of illegal sales of B.C. salmon.

- (Dec. 8, 1992). Salmon overfishing 'serious' setback Crosbie promises 1993 'action plan'.
- (Dec. 9, 1992). B.C. report critical of salmon pacts Transfer of commercial fishing rights to natives could ruin industry, study says.
- (Dec. 23, 1992). B.C. salmon imperilled by warming, study says Economic impact of coastal change examined in detail for first time.
- (June 25, 1993). Pacific salmon treaty draws fire deal branded a sellout by some in B.C. fishing industry.
- (July 10, 1993). B.C. ruling won't alter fishing plan Ottawa expanding commercial opportunities for natives.
- (Oct. 28, 1993). Native fishing not harmful, critics admit pilot project forecasts of a West Coast ecological calamity proved to be wrong after the best sockeye salmon run in 80 years.
- The Vancouver Sun (May 27, 1994). Canada ready for war with U.S. over fish: No option but to take unilateral action, Tobin says after talks break down.
- (Oct. 4, 1994). 3 million missing fish 'no disaster': Minister confident panel will find ways to rebuild resource.
- (Oct. 7, 1994). DFO officials in the dark, report claims.
- (Oct. 17, 1994). Blaming Indians for salmon shortfall seems grossly unfair.
- (Nov. 2, 1994). Conservation to get 'priority' in B.C. fishery.
- (Nov. 23, 1994). Sto:lo tried to warn Tobin, director says.
- (Aug. 8, 1995). Diminished salmon run 'bad omen': Salmon.

- (Aug. 10, 1995). Fishing disaster sparks closures: Move averts threat of confrontation with Indians: FISH
- (Aug. 14, 1995). Minister seeks aid for fishers hurt by salmon ban.
- (Sept. 28, 1995). Fishery groups hook up over salmon problems.
- (Dec. 7, 1995). Tobin predicts another poor salmon season: FISH.
- (April 6, 1996). Get ruthless to save salmon stocks.
- (April 10, 1996). What the minister's salmon plan will do, what it should do.
- (April 13, 1996). Mifflin's salmon scheme built on illusion.
- (April 17, 1996). Clark wants fast action on Pacific salmon talks.
- (April 29, 1996). Angry B.C. fishers head to Ottawa to fight against salmon-fleet cuts: 'Better alternative' proposed by fishers' union.
- (Jan. 21, 1998). Fishermen jeer minister on federal salmon policy: David Anderson Says Reducing B.C.'s Fleet Has Been a Success.
- (Nov. 22, 2016). B.C. government unveils details of affordable housing fund. Retrieved from <http://VancouverSun.Com/News/Politics/Government-Unveils-Details-of-Affordable-Housing-Fund>
- (June 10, 2017). Advocates ask how B.C. could house Balmoral residents within a week, but others wait years. Retrieved from <http://VancouverSun.Com/News/Local-News/Housing-Advocates-Question-Social-Housing-for-Sro-Evictes-Amid-Homeless-Crisis>

- Thompson, J. D. (1967). *Organizations in Action*. New York: McGraw-Hill.
- Thompson, J. D. and Tuden, A. (1959). Strategies, Structures, and Processes of Organizational Decision. In J. D. Thompson et al., *Comparative Studies in Administration*. Pittsburgh: University of Pittsburgh Press.
- Toy, S. (1998). *Recommendations for Policy Changes Implementing Several Recommendations of Dr. A. W. May's Report "Altering Course" on Intersectoral Allocations of Salmon in British Columbia*. Prepared for the Minister of Fisheries and Oceans, March 16, 1998. AHO-16393. Department of Fisheries and Oceans, Government of Canada.
- Tsoukas, H. (1989). The Validity of Idiographic Research Explanations. *The Academy of Management Review*, 14(4), 551-561.
- Turrini, A., Cristofoli, D., Frosini, F. and Nasi, G. (2010). Networking Literature about Determinants of Network Effectiveness. *Public Administration*, 88(2), 528-550.
- Tversky, A., and Kahnemann, D. (1986). Rational Choice and the Framing of Decisions. *The Journal of Business*, 59(4), Part 2: The Behavioral Foundations of Economic Theory, S251-S278.
- Tversky, A., and Kahneman, D. (1981). The Framing of Decisions and the Psychology of Choice. *Science, New Series*, 211(4481), 453-458.
- Van De Ven, A., and Huber, P. (1990). Longitudinal Field Research Methods for Studying Processes of Organizational Change. *Organization Science*, 1(3), Special Issue: Longitudinal Field Research Methods for Studying Processes of Organizational Change, 213-221.
- Van Latesteijn, H. and Rabbinge, R. (2012). Wicked Problems in Sustainable Agriculture and Food Security, the Transforum Experience. *International Food and Agribusiness Management Review*, 15(B), 89-94.
- Verweij, M., Douglas, M., Ellis, R. and Thompson, M. (2006). Clumsy Solutions for a Complex World: The Case of Climate Change. *Public Administration*, 84(4), 817-843.

- Vo, H. V., Chae, B., and Olson, D. L. (2007). Developing Unbounded Systems Thinking: Using Causal Mapping with Multiple Stakeholders within a Vietnamese Company. *The Journal of the Operational Research Society*, 58(5), 655-668.
- von Bertalanffy (1969). *General system theory; foundations, development, applications*. New York: G. Braziller.
- von Neumann, J. and Morgenstern, O. (1947). *Theory of Games and Economic Behavior*. Princeton, NJ: Princeton University Press.
- Wang, X. T. (1996). Framing Effects: Dynamics and Task Domains. *Organizational Behavior and Human Decision Processes*, 68(2), 145-157.
- Weber, E. and Khademian, A. M (2008a). Wicked Problems, Knowledge Challenges, and Collaborative Capacity Builders in Network Settings. *Public Administration Review*, 68(2), 334-349.
- Weber, E., Memon, A. and Painter, B. (2011). Science, Society, and Water Resources in New Zealand: Recognizing and Overcoming a Societal Impasse. *Journal of Environmental Policy and Planning*, 13(1), 49-69.
- Weible, C. (2005). Beliefs and Perceived Influence in a Natural Resource Conflict: An Advocacy Coalition Approach to Policy Networks. *Political Research Quarterly*, 58(3), 461-475.
- Weick, K. E. (1969). *The Social Psychology of Organizing* (1<sup>st</sup> ed.). Reading, Mass: Addison-Wesley Pub.Co.
- Weick, K. E. (1979). *The Social Psychology of Organizing* (2<sup>nd</sup> ed.). Reading, Mass: Addison-Wesley Pub.Co.
- Weick, K. E. (1995). *Sensemaking in Organizations*. Thousand Oaks, CA: Sage.
- Weick, K. E., and Sutcliffe, K. M. (2006). Mindfulness and the Quality of Organizational Attention. *Organization Science*, 17(4) 514-524.

- West, W. (2005). Administrative Rulemaking: An Old and Emerging Literature. *Public Administration Review*, 65(6), 655-668.
- Wilkinson, A. and Mangalagiu, D. (2012). Learning with futures to realise progress towards sustainability: The WBCSD Vision 2050 Initiative. *Futures*, 44, 372-384.
- Williams, P. (2006). The Governance of Sustainable Development in Wales. *Local Environment*, 11(3), 253-267.
- Williamson, O. E. (1975). *Markets and Hierarchies*. New York: Free Press.
- Wilson, R. S., Arvai, J. L. and Arkes, H. R. (2008). *Risk Analysis*, 28(4), 929-938.
- Woolthuis, R. K., Hooimeijer, F., Bossink, B. Et Al. (2013). Institutional Entrepreneurship in Sustainable Urban Development: Dutch Successes as Inspiration for Transformation. *Journal of Cleaner Production*, 50, 91-100.
- Workman, S., Jones, B.D. and Jochim, A. E. (2009). Information Processing and Policy Dynamics. *The Policy Studies Journal*, 37(1), 75-92.
- Wubben, E. and Nuhoff-Isakhanyan, G. (2012). The Wicked Problem of Promoting Sustainability By Means of Enhanced Biomass Utilization. *International Food and Agribusiness Management Review*, 16(A), 45-50.
- Xenakis, A. and Loukis, E. (2010). Using Structured e-Forum to Support the Legislation Formation Process. In A.B. Sideridis and Ch. Z. Patrikakis (eds.), *e-Democracy 2009*, pp. 29-40. Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering.
- Xiang, W. (2013). Working With Wicked Problems in Socio-Ecological Systems: Awareness, Acceptance, and Adaptation. *Landscape and Urban Planning*, 110, 1-4.
- Yaniv, E., and Schwartz, D. (2011). Organizational Attention. in Schwartz and Te'eni (Eds.), *Encyclopedia of Knowledge Management*, Second Edition. IGI Global.
- Yechiam, E. and Hochman, G. (2013). Losses as Modulators of Attention: Review and Analysis of the Unique Effects of Losses over Gains. *Psychological Bulletin*, 139(2), 497-518.

- Yin R.K. (2009). *Case Study Research: Design and Method* (4<sup>th</sup> ed.). Thousand Oaks, CA: Sage.
- Yin, R.K. (2003). *Applications of Case Study Research* (2<sup>nd</sup> ed.). Thousand Oaks, CA: Sage.
- Zacks, J. and Tversky, B. (2001). Event Structure in Perception and Conception. *Psychological Bulletin*, 127(1), 3-21.
- Zahariadis, N. (2007). The multiple streams framework: Structure, limitations, prospects. In P. Sabatier (ed.), *Theories of the policy process* (2<sup>nd</sup> ed). Boulder, CO: Westview Press.
- Zia, A. and Glantz, M. H. (2012). Risk Zones: Comparative Lesson Drawing and Policy Learning from Flood Insurance Programs. *Journal of Comparative Policy Analysis: Research and Practice*, 14(2), 143-159.

## Appendix A. Search queries and results

Database	Date	Key Terms	Search field	Results (Qs)
WoS	28/01/2014	wicked AND problem*	Topic	397
		wicked AND problem* AND polic*		131
		wicked AND problem* AND public polic*		59
		wicked AND problem* AND public sector		14
		wicked AND problem* AND public organization*		26
		wicked AND problem* AND govern*		102
		wicked AND issue*		140
	02/04/2014	wicked AND (problem* OR issue*) AND public administration		9
EBSCO	11/02/2014	wicked AND problem*	Title	91
		wicked AND problem* AND polic*		8
		wicked AND problem* AND public polic*		0
		wicked AND problem* AND public sector		0
		wicked AND problem* AND public organization*		0
		wicked AND problem* AND govern*		5
		wicked AND issue*		7
	18/02/2014	wicked AND problem*	Abstract	201
		wicked AND problem* AND polic*		56
		wicked AND problem* AND public polic*		20
		wicked AND problem* AND public sector		1
		wicked AND problem* AND public organization*		2
		wicked AND problem* AND govern*		43
	wicked AND issue*	134		
02/04/2014	wicked AND (problem* OR issue*) AND public administration		2	
03/04/2014	wicked AND (problem* OR issue*) AND public administration	Select a Field (optional)	42	
03/03/2014	wicked AND (problem* OR issue*)	Key Words	44	
JSTOR	07/03/2014	wicked AND (problem* OR issue*)	Title	27
		wicked AND (problem* OR issue*) AND public administration		0
	03/04/2014	wicked AND (problem* OR issue*)	Abstract	124
wicked AND (problem* OR issue*) AND public administration	13			
Directory	14/03/2015	"wicked problems"	Search All	27

		"wicked problem"		15
		"wicked policy problems" /...problem"		0
		"wicked issues"		2
		"wicked issue"		0
		"wicked policy issue"		1

## Appendix B. Appraisal instrument

Author: \_\_\_\_\_ Year: \_\_\_\_\_

Source: \_\_\_\_\_ Record number: \_\_\_\_\_

Question	Yes	No	Unclear	Not Applicable
Is there congruity between how the concept wicked problem is used in the document and the review questions? (i.e., is this wicked problem a policy issue that fall under the purview of public officials and governmental organizations?)				
Do the authors explicitly cite Rittel and Weber et al. (1973) or similar?				
Is the study design clearly specified?				
Is this an empirical paper? (i.e., existence of evidence to support arguments and conclusions)				
Are the data collection strategies and/or tools clearly described?				
Is the data analysis clearly described?				
Does the paper make a useful contribution?				

Overall appraisal:

Include: \_\_\_\_\_

Exclude: \_\_\_\_\_

Comments (including reason for exclusion)

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## Appendix C. Empirical research on wicked problems by country

Country	Total	Percentage
USA	35	23,5%
Australia	25	16,8%
UK	26	17,4%
Netherlands	19	12,8%
New Zealand	7	4,7%
Canada	5	3,4%
Norway	3	2,0%
Switzerland	2	1,3%
Sweden	2	1,3%
Finland	2	1,3%
Greece	2	1,3%
Austria	1	0,7%
Germany	1	0,7%
India	1	0,7%
Italy	1	0,7%
Australia; China	1	0,7%
Australia; Wales	1	0,7%
Canada; Brazil; Peru; Ecuador	1	0,7%
Denmark; USA	1	0,7%
England; Canada	1	0,7%
England; Germany	1	0,7%
England; USA	1	0,7%
Ethiopia; India	1	0,7%
France; Australia; Madagascar; USA	1	0,7%
Indonesia; USA; England	1	0,7%
Italy; Greece	1	0,7%
South Africa; Canada	1	0,7%
Spain; Germany	1	0,7%
Switzerland; Belgium	1	0,7%
USA; Argentina	1	0,7%
USA; Canada	1	0,7%
USA; New Zealand	1	0,7%
Total general	<b>149</b>	<b>100%</b>

## Appendix D. Wicked problems grouped by policy area

POLICY AREAS	WICKED PROBLEM (GENERAL)	TOTAL
<b>Environment</b>	Pollution	4
	Environmental sustainability	3
	Dryland management	2
	Natural resource planning	2
	Protection of endangered species	2
	Environmental regulation	1
	Long term funding for governance institutions for climate adaptation	1
	Indirect land-use change (ILUC)	1
	Nuclear waste management (NWM)	1
	Climate-mediated changes in wildfire regime	1
	Climate change	1
	Housing and accommodation in mining-affected communities	1
	Climate change adaptation	1
	Unmanaged Recreation in National Forests	1
	Airport expansion	1
	Global environmental issues	1
	<b>Total Environment</b>	<b>24</b>
<b>Public health</b>	Provision of Public health services	6
	Public health issues	3
	Pollution	3
	Institutional abuse in care settings	1
	Health inequalities	1
	Public drinking	1
	Quality problems in health care	1
	Early Childhood Safety at Home	1
	GM food production	1
	Potential risks of emerging technologies	1
		<b>Total Public health</b>
<b>Agriculture</b>	Environmental sustainability	4
	Food security	2
	Human-elephant conflicts (HEC)	1
	Climate change + Food security	1
	Sustainable development	1
	Climate change	1
	Horse-related problems	1
	Environmental sustainability + Food security	1
	Sustainable biomass utilization	1
	Evaluation of subsidy programs	1
	Sustainable production of soy	1
	Branding in rural areas	1
	Global environmental issues	1
		<b>Total Agriculture</b>
<b>Urban development</b>	Sustainable urban planning	4

	Climate change adaptation	2
	Urban decline	2
	Climate change + Socio-spatial inequality	1
	Social and Environmental sustainability	1
	Traffic congestion	1
	Climate change	1
	Environmental sustainability	1
	Regional planning	1
	<b>Total Urban development</b>	<b>14</b>
<b>Policy making &amp; analysis</b>	"Wicked problems" [Gral]	3
	Policy making and implementation	2
	State/civil society relations	1
	Anti-social behaviour (ASB)	1
	Nimby syndrome	1
	Brain drain	1
	Social exclusion	1
	Dryland management	1
	Water governance + Airspace regulation	1
	Employment and national insurance administrations	1
	Knowledge Management in non-hierarchical government policy-making groups	1
	<b>Total Policy making &amp; analysis</b>	<b>14</b>
<b>Water management</b>	Water governance	4
	Water sector sustainability	1
	Groundwater contamination	1
	Dryland management	1
	Water pollution	1
	Environmental sustainability	1
	Climate change	1
	Flood safety	1
	<b>Total Water management</b>	<b>11</b>
<b>Public management</b>	"Wicked problems" [Gral]	2
	Planning and management of public events	2
	Organizational change	2
	Social and Environmental sustainability	1
	Emergency management + Environmental regulation + Community renewal	1
	Sustainable development	1
	Leadership in regional engagement	1
	River management	1
	<b>Total Public management</b>	<b>11</b>
<b>Fisheries</b>	Ecosystem recovery	1
	Reef degradation	1
	Protection of (endangered) species	1
	Lack of adaptability in fish stocking policy	1
	Social and Environmental sustainability	1
	Management of Marine Biodiversity	1
	Poverty	1
	<b>Total Fisheries</b>	<b>7</b>
<b>National security and</b>	National security	3

	Peacebuilding and Statebuilding	1
	Vessel traffic safety	1
	Peace and security	1
	<b>Total National security and Defense policy</b>	<b>6</b>
<b>Education</b>	Social exclusion	1
	"Wicked problems" [Gral]	1
	Vocational skill training	1
	Policy making and implementation	1
	Racism	1
	<b>Total Education policy</b>	<b>5</b>
<b>Local government</b>	"Wicked problems" [Gral]	2
	Urban decline	1
	Regional planning	1
	<b>Total Local government</b>	<b>4</b>
<b>Energy</b>	Environmental sustainability	1
	Wind energy siting	1
	Policy making and implementation	1
	<b>Total Energy policy</b>	<b>3</b>
<b>Forestry</b>	Climate change	1
	Pollution	1
	Deforestation and Forest Degradation	1
	<b>Total Forest policy</b>	<b>3</b>
<b>Disaster &amp; Emergency management</b>	Use of nuclear fusion energy	1
	Designation of risk zones	1
	<b>Total Disaster &amp; Emergency management</b>	<b>2</b>
<b>Family and child affairs</b>	Teenage pregnancy	1
	Domestic violence	1
	<b>Total Family and child policy</b>	<b>2</b>
<b>Economic policy</b>	Economic problems	1
<b>Indigenous affairs</b>	Indigenous disadvantage	1
<b>Tourism</b>	Sustainable tourism activities	1
<b>e-government</b>	"Wicked problems" [Gral]	1
<b>Environment and Public health</b>	Climate change + Human genetics	1
<b>Employment</b>	Work-family relationship issues	1
<b>Sport</b>	Policy making and implementation	1
<b>TOTAL GENERAL</b>		<b>149</b>

## Appendix E. Sources on wicked policy problems by disciplines

Journal subject categories in Journal Citations Report	Total
Public Administration	12
Environmental Studies	7
Planning & Development; Public Administration; Social Sciences, Interdisciplinary	5
Education & Educational Research	4
Environmental Sciences	4
Political Science; Public Administration	4
Environmental Studies; Public Administration	3
Management; Social Sciences, Interdisciplinary	2
Political Science	2
Information Science & Library Science; Management	2
International Relations	2
Health Policy & Services	2
Economics	2
Public, Environmental & Occupational Health	2
Information Science & Library Science	2
Health Policy & Services; Public, Environmental & Occupational Health	2
Economics; Planning & Development	1
Food Science & Technology	1
Social Sciences, Interdisciplinary	1
Geography; Sociology	1
Environmental Studies; Law	1
Business; Ethics	1
Ethics	1
Agronomy	1
Urban Studies	1
Hospitality, Leisure, Sport & Tourism	1
Planning & Development; Political Science; Public Administration	1
Ecology	1
Environmental Studies; Planning & Development; Sociology	1
Business; Communication	1
Environmental Studies; Urban Studies	1
Environmental Studies; Hospitality, Leisure, Sport & Tourism; Management	1
Public, Environmental & Occupational Health; Social Sciences, Biomedical; Sociology	1
Law; Political Science; Public Administration	1
Substance Abuse	1
Management; Public Administration	1

Women's Studies	1
Environmental Studies; International Relations	1
Geography	1
Planning & Development	1
Total general	<b>81</b>

## Appendix F. Sources of empirical studies on wicked sustainability problems

Source	Total
International Food And Agribusiness Management Review	7
Environment And Planning C-Government And Policy	2
Journal Of Environmental Policy & Planning	2
Sustainability	2
Nature + Culture [Book]	1
Conservation Biology	1
Journal Of Business Ethics	1
Environmental Security In Watersheds: The Sea Of Azov [Book]	1
Local Environment	1
Greener Management International	1
Journal Of Agricultural & Environmental Ethics	1
Housing Studies	1
Journal Of Cleaner Production	1
Implementation Science	1
Journal Of Sustainable Tourism	1
Institutional Analysis And Praxis: The Social Fabric Matrix Approach [Book]	1
Marine Policy	1
Policy Sciences	1
Environmental Science & Policy	1
Advances In Agronomy	1
Transforum Model: Transforming Agro Innovation Toward Sustainable Development [Book]	1
Administrative Theory & Praxis	1
International Journal Of Urban & Regional Research	1
Total General	<b>32</b>

## Appendix G. Research methods of resources on wicked sustainability problems

Research design	Data Collection	Data Analysis	Total
Case study	Group discussions	(Not specified)	1
		Grounded theory	1
	Interviews	Constructive analysis	1
	Interviews + Observations + Secondary data	(Not specified)	1
	Interviews + Secondary data	(Not specified)	3
		Grounded theory (+ Actor-Network Theory + Negotiated Order Theory)	1
	Interviews + Secondary data + Observation (participatory)	(Not specified)	1
		Qualitative content analysis + Discourse analysis	1
	Interviews + Secondary data + Observations	Grounded theory	1
	Secondary data	(Not specified)	7
		Textual analysis	1
		Content analysis	1
		Quantitative analysis (regression model)	1
	<b>Total Case study</b>		
Comparative Case Study	Interviews + Secondary data	Grounded theory	1
	Interviews + Secondary data + Group discussions	(Not specified)	1
	Interviews + Secondary data + Observation (participatory)	(Not specified)	1
	Interviews + Secondary data + Survey	Content analysis	1
	Interviews + Secondary data + Survey + Group discussions	Narrative analysis	1
	Secondary data	Historic/Longitudinal analysis	1
		(Not specified)	1
		Network analysis + Documentary analysis	1
	Survey	(Not specified)	1
	<b>Total Comparative Case Study</b>		
Q methodology (participatory approach)	Interviews + Secondary data + Group discussions	Q analysis	1
Action experiments	Group discussions + Secondary data	Multi-stakeholders approach	1
<b>Total general</b>			<b>32</b>

## Appendix H. Interview guide

### (1) Introduction and History

- (i) Could you tell me a little about your experience in matters related to the sustainability of the Pacific salmon?
- (ii) What are the key challenges faced in the sustainability of the Pacific salmon?
- (iii) What are key opportunities pertaining to the sustainability of Pacific salmon?

### (2) Developing a profile of critical issues

- (i) Can you describe a critical incident that you experienced or observed which had the most **negative** long term effect on the sustainability of the Pacific salmon in the last 30 years?
- (ii) Can you describe a critical incident that you experienced or observed which had the most **positive** long term effect on the sustainability of the Pacific salmon in the last 30 years?

### (3) Developing a profile of environmental events

- (i) Can you describe an environmental event that you experienced or observed which had the most **negative** long term effect on the sustainability of the Pacific salmon in the last 30 years?
- (ii) Can you describe a critical environmental event that you experienced or observed which had the most **positive** long term effect on the sustainability of the Pacific salmon in the last 30 years?

### (4) Developing a profile of the legislation, treaties, policies and plans as events

- (i) Can you describe a critical piece of legislation, treaty, policy and/or plan that had the most **negative** long term effect on the sustainability of the Pacific salmon in the last 30 years?
- (ii) Can you describe a legislation/treaty/policy/plan which had the most **positive** long term effect on the sustainability of the Pacific salmon in the last 30 years?

### 5) Developing a profile of social events

(i) Can you describe a social event (e.g., protests, debates, social and/or cultural crisis) that you experienced or observed which had the most **negative** long term effect on the sustainability of the Pacific salmon in the last 30 years?

(ii) Can you describe a social event that you experienced or observed which had the most **positive** long term effect on the sustainability of the Pacific salmon in the last 30 years?

6) Developing a profile of economic events

(i) Can you describe an economic event (e.g., financial crisis, economic adversity or turning point) that you experienced or observed which had the most **negative** long term effect on the sustainability of the Pacific salmon in the last 30 years?

(ii) Can you describe an economic event that you experienced or observed which had the most **positive** long term effect on the sustainability of the Pacific salmon in the last 30 years?

## Appendix I. Log of questions and answers (ETHNO)

### Cycle 1990-1993 events

#### Sparrow Decision

##### AF Co-op Management

Sparrow Decision: **linked**: (Working upward, Historical Causation question)

##### Weather disturbance

AF Co-op Management: not linked: (Working upward, Historical Causation question)

Sparrow Decision: not linked: (Working upward, Historical Causation question)

##### PSC breakdown

AF Co-op Management: not linked: (Working upward, Historical Causation question)

Weather disturbance: not linked: (Working upward, Historical Causation question)

Sparrow Decision: not linked: (Working upward, Historical Causation question)

#### AFS

AF Co-op Management: **linked**: (Working upward, Historical Causation question)

PSC breakdown: not linked: (Working upward, Historical Causation question)

Weather disturbance: not linked: (Working upward, Historical Causation question)

#### Agreements DFO-FN

AFS: **linked**: (Working upward, Historical Causation question)

PSC breakdown: not linked: (Working upward, Historical Causation question)

Weather disturbance: not linked: (Working upward, Historical Causation question)

#### Pilot sale project

Agreements DFO-FN: **linked**: (Working upward, Historical Causation question)

PSC breakdown: not linked: (Working upward, Historical Causation question)

Weather disturbance: not linked: (Working upward, Historical Causation question)

#### AFS enforcement problem

Pilot sale project: **linked**: (Working upward, Historical Causation question)

PSC breakdown: not linked: (Working upward, Historical Causation question)

Weather disturbance: not linked: (Working upward, Historical Causation question)

#### Intense unregulated fishing

AFS enforcement problem: **linked**: (Working upward, Historical Causation question)

PSC breakdown: **linked**: (Working upward, Historical Causation question)

Weather disturbance: not linked: (Working upward, Historical Causation question)

#### Missing sockeye

Intense unregulated fishing: **linked**: (Working upward, Historical Causation question)

Weather disturbance: **linked**: (Working upward, Historical Causation question)

### **DFO fishing closure**

Missing sockeye: **linked**: (Working upward, Historical Causation question)

### **Conflict DFO-stakeholders**

DFO fishing closure: **linked**: (Working upward, Historical Causation question)

### **Conflicts b/stakeholders**

Conflict DFO-stakeholders: not linked: (Working upward, Historical Causation question)

DFO fishing closure: not linked: (Working upward, Historical Causation question)

Missing sockeye: **linked**: (Working upward, Historical Causation question)

### **Protests commercial fishermen**

Conflict DFO-stakeholders: not linked: (Working upward, Historical Causation question)

Conflicts b/stakeholders: not linked: (Working upward, Historical Causation question)

DFO fishing closure: not linked: (Working upward, Historical Causation question)

Missing sockeye: **linked**: (Working upward, Historical Causation question)

### **DFO internal investigation**

Conflict DFO-stakeholders: not linked: (Working upward, Historical Causation question)

Protests commercial fishermen: not linked: (Working upward, Historical Causation question)

Conflicts b/stakeholders: not linked: (Working upward, Historical Causation question)

DFO fishing closure: not linked: (Working upward, Historical Causation question)

Missing sockeye: **linked**: (Working upward, Historical Causation question)

### **Loss of confidence in DFO**

Conflict DFO-stakeholders: **linked**: (Working upward, Historical Causation question)

DFO internal investigation: not linked: (Working upward, Historical Causation question)

Protests commercial fishermen: not linked: (Working upward, Historical Causation question)

Conflicts b/stakeholders: **linked**: (Working upward, Historical Causation question)

### **P&L independent investigation**

Loss of confidence in DFO: **linked**: (Working upward, Historical Causation question)

DFO internal investigation: not linked: (Working upward, Historical Causation question)

Protests commercial fishermen: **linked**: (Working upward, Historical Causation question)

### **DFO Action Plan**

P&L independent investigation: linked: (Working upward, Historical Causation question)

DFO internal investigation: not linked: (Working upward, Historical Causation question)

### **Protest commercial fishermen 2**

DFO Action Plan: linked: (Working upward, Historical Causation question)

DFO internal investigation: not linked: (Working upward, Historical Causation question)

### **Conflict b/stakeholders 2**

Protest commercial fishermen 2: not linked: (Working upward, Historical Causation question)

DFO Action Plan: linked: (Working upward, Historical Causation question)

DFO internal investigation: not linked: (Working upward, Historical Causation question)

### **Fraser & Skeena Plan (enforcement)**

conflict b/stakeholders 2: not linked: (Working upward, Historical Causation question)

Protest commercial fishermen 2: not linked: (Working upward, Historical Causation question)

DFO Action Plan: linked: (Working upward, Historical Causation question)

DFO internal investigation: not linked: (Working upward, Historical Causation question)

### **Extensive agreements DFO-FN**

Fraser & Skeena Plan (enforcement): linked: (Working upward, Historical Causation question)

conflict b/stakeholders 2: not linked: (Working upward, Historical Causation question)

Protest commercial fishermen 2: not linked: (Working upward, Historical Causation question)

DFO internal investigation: not linked: (Working upward, Historical Causation question)

### **PSC breakdown 2**

Extensive agreements DFO-FN: not linked: (Working upward, Historical Causation question)

Fraser & Skeena Plan (enforcement): not linked: (Working upward, Historical Causation question)

conflict b/stakeholders 2: not linked: (Working upward, Historical Causation question)

Protest commercial fishermen 2: not linked: (Working upward, Historical Causation question)

DFO Action Plan: not linked: (Working upward, Historical Causation question)

P&L independent investigation: not linked: (Working upward, Historical Causation question)

Loss of confidence in DFO: not linked: (Working upward, Historical Causation question)

Conflict DFO-stakeholders: not linked: (Working upward, Historical Causation question)

DFO internal investigation: not linked: (Working upward, Historical Causation question)

Protests commercial fishermen: not linked: (Working upward, Historical Causation question)

Conflicts b/stakeholders: not linked: (Working upward, Historical Causation question)

DFO fishing closure: not linked: (Working upward, Historical Causation question)

Missing sockeye: not linked: (Working upward, Historical Causation question)

Intense unregulated fishing: not linked: (Working upward, Historical Causation question)

AFS enforcement problem: not linked: (Working upward, Historical Causation question)

Pilot sale project: not linked: (Working upward, Historical Causation question)

Agreements DFO-FN: not linked: (Working upward, Historical Causation question)

AFS: not linked: (Working upward, Historical Causation question)

AF Co-op Management: not linked: (Working upward, Historical Causation question)

PSC breakdown: **linked**: (Working upward, Historical Causation question)

Weather disturbance: not linked: (Working upward, Historical Causation question)

Sparrow Decision: not linked: (Working upward, Historical Causation question)

## **New PST**

Extensive agreements DFO-FN: not linked: (Working upward, Historical Causation question)

Fraser & Skeena Plan (enforcement): not linked: (Working upward, Historical Causation question)

conflict b/stakeholders 2: not linked: (Working upward, Historical Causation question)

Protest commercial fishermen 2: not linked: (Working upward, Historical Causation question)

DFO Action Plan: not linked: (Working upward, Historical Causation question)

P&L independent investigation: not linked: (Working upward, Historical Causation question)

Loss of confidence in DFO: not linked: (Working upward, Historical Causation question)

Conflict DFO-stakeholders: not linked: (Working upward, Historical Causation question)

DFO internal investigation: not linked: (Working upward, Historical Causation question)

Protests commercial fishermen: not linked: (Working upward, Historical Causation question)

Conflicts b/stakeholders: not linked: (Working upward, Historical Causation question)

DFO fishing closure: not linked: (Working upward, Historical Causation question)

Missing sockeye: not linked: (Working upward, Historical Causation question)

Intense unregulated fishing: not linked: (Working upward, Historical Causation question)

AFS enforcement problem: not linked: (Working upward, Historical Causation question)

Pilot sale project: not linked: (Working upward, Historical Causation question)

Agreements DFO-FN: not linked: (Working upward, Historical Causation question)

AFS: not linked: (Working upward, Historical Causation question)

PSC breakdown 2: **linked**: (Working upward, Historical Causation question)

AF Co-op Management: not linked: (Working upward, Historical Causation question)

Weather disturbance: not linked: (Working upward, Historical Causation question)

Sparrow Decision: not linked: (Working upward, Historical Causation question)

### **BC court against pilot sale**

Extensive agreements DFO-FN: not linked: (Working upward, Historical Causation question)

Fraser & Skeena Plan (enforcement): not linked: (Working upward, Historical Causation question)

conflict b/stakeholders 2: not linked: (Working upward, Historical Causation question)

Protest commercial fishermen 2: not linked: (Working upward, Historical Causation question)

DFO Action Plan: not linked: (Working upward, Historical Causation question)

P&L independent investigation: not linked: (Working upward, Historical Causation question)

Loss of confidence in DFO: not linked: (Working upward, Historical Causation question)

Conflict DFO-stakeholders: not linked: (Working upward, Historical Causation question)

DFO internal investigation: not linked: (Working upward, Historical Causation question)

Protests commercial fishermen: not linked: (Working upward, Historical Causation question)

Conflicts b/stakeholders: not linked: (Working upward, Historical Causation question)

DFO fishing closure: not linked: (Working upward, Historical Causation question)

Missing sockeye: not linked: (Working upward, Historical Causation question)

Intense unregulated fishing: not linked: (Working upward, Historical Causation question)

AFS enforcement problem: not linked: (Working upward, Historical Causation question)

Pilot sale project: **linked**: (Working upward, Historical Causation question)

New PST: not linked: (Working upward, Historical Causation question)

PSC breakdown 2: not linked: (Working upward, Historical Causation question)

PSC breakdown: not linked: (Working upward, Historical Causation question)

Weather disturbance: not linked: (Working upward, Historical Causation question)

### **DFO continues pilot sale**

Extensive agreements DFO-FN: not linked: (Working upward, Historical Causation question)

Fraser & Skeena Plan (enforcement): not linked: (Working upward, Historical Causation question)

conflict b/stakeholders 2: not linked: (Working upward, Historical Causation question)

Protest commercial fishermen 2: not linked: (Working upward, Historical Causation question)

DFO Action Plan: not linked: (Working upward, Historical Causation question)

P&L independent investigation: not linked: (Working upward, Historical Causation question)

Loss of confidence in DFO: not linked: (Working upward, Historical Causation question)

Conflict DFO-stakeholders: not linked: (Working upward, Historical Causation question)

DFO internal investigation: not linked: (Working upward, Historical Causation question)

Protests commercial fishermen: not linked: (Working upward, Historical Causation question)

Conflicts b/stakeholders: not linked: (Working upward, Historical Causation question)

DFO fishing closure: not linked: (Working upward, Historical Causation question)

Missing sockeye: not linked: (Working upward, Historical Causation question)

Intense unregulated fishing: not linked: (Working upward, Historical Causation question)

BC court against pilot sale: **linked**: (Working upward, Historical Causation question)

AFS enforcement problem: not linked: (Working upward, Historical Causation question)

New PST: not linked: (Working upward, Historical Causation question)

PSC breakdown 2: not linked: (Working upward, Historical Causation question)

PSC breakdown: not linked: (Working upward, Historical Causation question)

Weather disturbance: not linked: (Working upward, Historical Causation question)

### **Protest non-native fishers**

Extensive agreements DFO-FN: not linked: (Working upward, Historical Causation question)

Fraser & Skeena Plan (enforcement): not linked: (Working upward, Historical Causation question)

conflict b/stakeholders 2: not linked: (Working upward, Historical Causation question)

Protest commercial fishermen 2: not linked: (Working upward, Historical Causation question)

DFO Action Plan: not linked: (Working upward, Historical Causation question)

P&L independent investigation: not linked: (Working upward, Historical Causation question)

Loss of confidence in DFO: not linked: (Working upward, Historical Causation question)

Conflict DFO-stakeholders: not linked: (Working upward, Historical Causation question)

DFO internal investigation: not linked: (Working upward, Historical Causation question)

Protests commercial fishermen: not linked: (Working upward, Historical Causation question)

Conflicts b/stakeholders: not linked: (Working upward, Historical Causation question)

DFO fishing closure: not linked: (Working upward, Historical Causation question)

Missing sockeye: not linked: (Working upward, Historical Causation question)

DFO continues pilot sale: **linked**: (Working upward, Historical Causation question)

Intense unregulated fishing: not linked: (Working upward, Historical Causation question)

AFS enforcement problem: not linked: (Working upward, Historical Causation question)

New PST: not linked: (Working upward, Historical Causation question)

PSC breakdown 2: not linked: (Working upward, Historical Causation question)

PSC breakdown: not linked: (Working upward, Historical Causation question)

Weather disturbance: not linked: (Working upward, Historical Causation question)

### **1993 record sockeye salmon run**

Extensive agreements DFO-FN: **linked**: (Working upward, Historical Causation question)

conflict b/stakeholders 2: not linked: (Working upward, Historical Causation question)

Protest commercial fishermen 2: not linked: (Working upward, Historical Causation question)

DFO internal investigation: not linked: (Working upward, Historical Causation question)

Protest non-native fishers: not linked: (Working upward, Historical Causation question)

DFO continues pilot sale: not linked: (Working upward, Historical Causation question)

BC court against pilot sale: not linked: (Working upward, Historical Causation question)

New PST: **linked**: (Working upward, Historical Causation question)

### **Criticisms a/AFS fade**

1993 record sockeye salmon run: **linked**: (Working upward, Historical Causation question)

conflict b/stakeholders 2: not linked: (Working upward, Historical Causation question)

Protest commercial fishermen 2: not linked: (Working upward, Historical Causation question)

DFO internal investigation: not linked: (Working upward, Historical Causation question)

Protest non-native fishers: not linked: (Working upward, Historical Causation question)

DFO continues pilot sale: not linked: (Working upward, Historical Causation question)

BC court against pilot sale: not linked: (Working upward, Historical Causation question)

### **DFO feeling successful**

Criticisms a/AFS fade: not linked: (Working upward, Historical Causation question)

1993 record sockeye salmon run: **linked**: (Working upward, Historical Causation question)

conflict b/stakeholders 2: not linked: (Working upward, Historical Causation question)  
 Protest commercial fishermen 2: not linked: (Working upward, Historical Causation question)

DFO internal investigation: not linked: (Working upward, Historical Causation question)

Protest non-native fishers: not linked: (Working upward, Historical Causation question)

DFO continues pilot sale: not linked: (Working upward, Historical Causation question)

BC court against pilot sale: not linked: (Working upward, Historical Causation question)

### **Optimistic expectations 1994 season**

DFO feeling successful: not linked: (Working upward, Historical Causation question)

Criticisms a/AFS fade: not linked: (Working upward, Historical Causation question)

1993 record sockeye salmon run: **linked**: (Working upward, Historical Causation question)

conflict b/stakeholders 2: not linked: (Working upward, Historical Causation question)

Protest commercial fishermen 2: not linked: (Working upward, Historical Causation question)

DFO internal investigation: not linked: (Working upward, Historical Causation question)

Protest non-native fishers: not linked: (Working upward, Historical Causation question)

DFO continues pilot sale: not linked: (Working upward, Historical Causation question)

BC court against pilot sale: not linked: (Working upward, Historical Causation question)

**LINKING COMPLETED.**

### **Cycle 1994-1998 events**

#### **92/93 DFO Reorganization**

##### **AFS Enforcement problems**

92/93 DFO Reorganization: not linked: (Working upward, Historical Causation question)

##### **CAN-US PST breakdown**

AFS Enforcement problems: not linked: (Working upward, Historical Causation question)

92/93 DFO Reorganization: not linked: (Working upward, Historical Causation question)

##### **Aggressive fishing**

CAN-US PST breakdown: **linked**: (Working upward, Historical Causation question)

AFS Enforcement problems: not linked: (Working upward, Historical Causation question)

92/93 DFO Reorganization: not linked: (Working upward, Historical Causation question)

**Weather disturbance**

Aggressive fishing: not linked: (Working upward, Historical Causation question)  
 CAN-US PST breakdown: not linked: (Working upward, Historical Causation question)  
 AFS Enforcement problems: not linked: (Working upward, Historical Causation question)  
 92/93 DFO Reorganization: not linked: (Working upward, Historical Causation question)

**General enforcement breakdown**

Aggressive fishing: not linked: (Working upward, Historical Causation question)  
 Weather disturbance: not linked: (Working upward, Historical Causation question)  
CAN-US PST breakdown: **linked**: (Working upward, Historical Causation question)  
AFS Enforcement problems: **linked**: (Working upward, Historical Causation question)  
92/93 DFO Reorganization: **linked**: (Working upward, Historical Causation question)

**Missing sockeye (crisis)**

General enforcement breakdown: **linked**: (Working upward, Historical Causation question)  
Aggressive fishing: **linked**: (Working upward, Historical Causation question)  
Weather disturbance: **linked**: (Working upward, Historical Causation question)

**Conflict b/stakeholders**

Missing sockeye (crisis): **linked**: (Working upward, Historical Causation question)

**Loss of confidence in DFO**

Conflict b/stakeholders: not linked: (Working upward, Historical Causation question)  
Missing sockeye (crisis): **linked**: (Working upward, Historical Causation question)

**Fishing closure**

Loss of confidence in DFO: not linked: (Working upward, Historical Causation question)  
 Conflict b/stakeholders: not linked: (Working upward, Historical Causation question)  
Missing sockeye (crisis): **linked**: (Working upward, Historical Causation question)

**DFO technical groups**

Fishing closure: not linked: (Working upward, Historical Causation question)  
 Loss of confidence in DFO: not linked: (Working upward, Historical Causation question)  
 Conflict b/stakeholders: not linked: (Working upward, Historical Causation question)  
Missing sockeye (crisis): **linked**: (Working upward, Historical Causation question)

**Accusations of no credibility**

DFO technical groups: **linked**: (Working upward, Historical Causation question)  
 Fishing closure: not linked: (Working upward, Historical Causation question)

Loss of confidence in DFO: not linked: (Working upward, Historical Causation question)

Conflict b/stakeholders: not linked: (Working upward, Historical Causation question)

### **FRSPRB**

Accusations of no credibility: **linked**: (Working upward, Historical Causation question)

Fishing closure: not linked: (Working upward, Historical Causation question)

Loss of confidence in DFO: **linked**: (Working upward, Historical Causation question)

Conflict b/stakeholders: **linked**: (Working upward, Historical Causation question)

### **PFCC**

FRSPRB: **linked**: (Working upward, Historical Causation question)

Fishing closure: not linked: (Working upward, Historical Causation question)

### **5 point Action Plan**

PFCC: not linked: (Working upward, Historical Causation question)

FRSPRB: **linked**: (Working upward, Historical Causation question)

Fishing closure: not linked: (Working upward, Historical Causation question)

### **PPRT**

5 point Action Plan: **linked**: (Working upward, Historical Causation question)

PFCC: not linked: (Working upward, Historical Causation question)

Fishing closure: not linked: (Working upward, Historical Causation question)

### **Bad 95 season/Bad 96 estimates**

PPRT: not linked: (Working upward, Historical Causation question)

5 point Action Plan: not linked: (Working upward, Historical Causation question)

PFCC: not linked: (Working upward, Historical Causation question)

FRSPRB: not linked: (Working upward, Historical Causation question)

Accusations of no credibility: not linked: (Working upward, Historical Causation question)

DFO technical groups: not linked: (Working upward, Historical Causation question)

Fishing closure: not linked: (Working upward, Historical Causation question)

Loss of confidence in DFO: not linked: (Working upward, Historical Causation question)

Conflict b/stakeholders: not linked: (Working upward, Historical Causation question)

Missing sockeye (crisis): not linked: (Working upward, Historical Causation question)

General enforcement breakdown: not linked: (Working upward, Historical Causation question)

Aggressive fishing: not linked: (Working upward, Historical Causation question)

Weather disturbance: not linked: (Working upward, Historical Causation question)

CAN-US PST breakdown: not linked: (Working upward, Historical Causation question)

AFS Enforcement problems: not linked: (Working upward, Historical Causation question)

92/93 DFO Reorganization: not linked: (Working upward, Historical Causation question)

**5 consultative procs. (allocation)**

PPRT: **linked**: (Working upward, Historical Causation question)

PFCC: not linked: (Working upward, Historical Causation question)

Fishing closure: not linked: (Working upward, Historical Causation question)

Bad 95 season/Bad 96 estimates: not linked: (Working upward, Historical Causation question)

**Mifflin Plan (fleet reduction)**

5 consultative procs. (allocation): not linked: (Working upward, Historical Causation question)

PPRT: **linked**: (Working upward, Historical Causation question)

PFCC: not linked: (Working upward, Historical Causation question)

Fishing closure: not linked: (Working upward, Historical Causation question)

Bad 95 season/Bad 96 estimates: **linked**: (Working upward, Historical Causation question)

**Criticism to DFO**

Mifflin Plan (fleet reduction): **linked**: (Working upward, Historical Causation question)

5 consultative procs. (allocation): not linked: (Working upward, Historical Causation question)

PFCC: not linked: (Working upward, Historical Causation question)

Fishing closure: not linked: (Working upward, Historical Causation question)

**Conflicts b/stakeholders (MP)**

Criticism to DFO: not linked: (Working upward, Historical Causation question)

Mifflin Plan (fleet reduction): **linked**: (Working upward, Historical Causation question)

5 consultative procs. (allocation): not linked: (Working upward, Historical Causation question)

PFCC: not linked: (Working upward, Historical Causation question)

Fishing closure: not linked: (Working upward, Historical Causation question)

**BC-Ottawa salmon war**

Conflicts b/stakeholders (MP): not linked: (Working upward, Historical Causation question)

Criticism to DFO: not linked: (Working upward, Historical Causation question)

Mifflin Plan (fleet reduction): **linked**: (Working upward, Historical Causation question)

5 consultative procs. (allocation): not linked: (Working upward, Historical Causation question)

PFCC: not linked: (Working upward, Historical Causation question)

Fishing closure: not linked: (Working upward, Historical Causation question)

**Fed-Prov Tripartite Panel**

BC-Ottawa salmon war: **linked**: (Working upward, Historical Causation question)

Conflicts b/stakeholders (MP): **linked**: (Working upward, Historical Causation question)

Criticism to DFO: linked: (Working upward, Historical Causation question)  
 5 consultative procs. (allocation): not linked: (Working upward, Historical Causation question)  
 PFCC: not linked: (Working upward, Historical Causation question)  
 Fishing closure: not linked: (Working upward, Historical Causation question)

### **Modification of Mifflin Plan**

Fed-Prov Tripartite Panel: linked: (Working upward, Historical Causation question)  
 5 consultative procs. (allocation): not linked: (Working upward, Historical Causation question)  
 PFCC: not linked: (Working upward, Historical Causation question)  
 Fishing closure: not linked: (Working upward, Historical Causation question)

### **Poor 97 season**

Modification of Mifflin Plan: not linked: (Working upward, Historical Causation question)  
 Fed-Prov Tripartite Panel: not linked: (Working upward, Historical Causation question)  
 BC-Ottawa salmon war: not linked: (Working upward, Historical Causation question)  
 Conflicts b/stakeholders (MP): not linked: (Working upward, Historical Causation question)  
 Criticism to DFO: not linked: (Working upward, Historical Causation question)  
 Mifflin Plan (fleet reduction): not linked: (Working upward, Historical Causation question)  
 5 consultative procs. (allocation): not linked: (Working upward, Historical Causation question)  
 PPRT: not linked: (Working upward, Historical Causation question)  
 5 point Action Plan: not linked: (Working upward, Historical Causation question)  
 PFCC: not linked: (Working upward, Historical Causation question)  
 FRSPRB: not linked: (Working upward, Historical Causation question)  
 Accusations of no credibility: not linked: (Working upward, Historical Causation question)  
 DFO technical groups: not linked: (Working upward, Historical Causation question)  
 Fishing closure: not linked: (Working upward, Historical Causation question)  
 Loss of confidence in DFO: not linked: (Working upward, Historical Causation question)  
 Conflict b/stakeholders: not linked: (Working upward, Historical Causation question)  
 Missing sockeye (crisis): not linked: (Working upward, Historical Causation question)  
 General enforcement breakdown: not linked: (Working upward, Historical Causation question)  
 Aggressive fishing: not linked: (Working upward, Historical Causation question)  
 Bad 95 season/Bad 96 estimates: not linked: (Working upward, Historical Causation question)  
 Weather disturbance: not linked: (Working upward, Historical Causation question)  
 CAN-US PST breakdown: not linked: (Working upward, Historical Causation question)  
 AFS Enforcement problems: not linked: (Working upward, Historical Causation question)

92/93 DFO Reorganization: not linked: (Working upward, Historical Causation question)

### **Criticism to MP (2)**

Modification of Mifflin Plan: **linked**: (Working upward, Historical Causation question)  
 5 consultative procs. (allocation): not linked: (Working upward, Historical Causation question)  
 PFCC: not linked: (Working upward, Historical Causation question)  
 Fishing closure: not linked: (Working upward, Historical Causation question)  
Poor 97 season: **linked**: (Working upward, Historical Causation question)

### **DFO feeling successful**

Criticism to MP (2): not linked: (Working upward, Historical Causation question)  
 Modification of Mifflin Plan:  
 Redo  
 Criticism to MP (2): not linked: (Working upward, Historical Causation question)  
Modification of Mifflin Plan: **linked**: (Working upward, Historical Causation question)  
 5 consultative procs. (allocation): not linked: (Working upward, Historical Causation question)  
 PFCC: not linked: (Working upward, Historical Causation question)  
 Fishing closure: not linked: (Working upward, Historical Causation question)  
Poor 97 season: **linked**: (Working upward, Historical Causation question)

### **Coho Crisis**

DFO feeling successful: not linked: (Working upward, Historical Causation question)  
 Criticism to MP (2): not linked: (Working upward, Historical Causation question)  
 Modification of Mifflin Plan: not linked: (Working upward, Historical Causation question)  
 Fed-Prov Tripartite Panel: not linked: (Working upward, Historical Causation question)  
 BC-Ottawa salmon war: not linked: (Working upward, Historical Causation question)  
 Conflicts b/stakeholders (MP): not linked: (Working upward, Historical Causation question)  
 Criticism to DFO: not linked: (Working upward, Historical Causation question)  
 Mifflin Plan (fleet reduction): not linked: (Working upward, Historical Causation question)  
 5 consultative procs. (allocation): not linked: (Working upward, Historical Causation question)  
 PPRT: not linked: (Working upward, Historical Causation question)  
 5 point Action Plan: not linked: (Working upward, Historical Causation question)  
 PFCC: not linked: (Working upward, Historical Causation question)  
 FRSPRB: not linked: (Working upward, Historical Causation question)  
 Accusations of no credibility: not linked: (Working upward, Historical Causation question)  
 DFO technical groups: not linked: (Working upward, Historical Causation question)  
 Fishing closure: not linked: (Working upward, Historical Causation question)

Loss of confidence in DFO: not linked: (Working upward, Historical Causation question)

Conflict b/stakeholders: not linked: (Working upward, Historical Causation question)

Missing sockeye (crisis): not linked: (Working upward, Historical Causation question)

General enforcement breakdown: not linked: (Working upward, Historical Causation question)

Aggressive fishing: not linked: (Working upward, Historical Causation question)

Poor 97 season: not linked: (Working upward, Historical Causation question)

Bad 95 season/Bad 96 estimates: not linked: (Working upward, Historical Causation question)

Weather disturbance: not linked: (Working upward, Historical Causation question)

CAN-US PST breakdown: not linked: (Working upward, Historical Causation question)

AFS Enforcement problems: not linked: (Working upward, Historical Causation question)

92/93 DFO Reorganization: not linked: (Working upward, Historical Causation question)

**LINKING COMPLETED.**