From scientific knowledge on climate change to adaptation of the French railway system. A social inquiry on SNCF processes

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Project presentation and summary

This thesis describes and analyzes *in situ* how a big company deals with the scientific knowledge on the impacts of climate change. It is the outcome of a joint-project between the CEARC (laboratory of the University Paris Saclay), I4CE (the Institute for Climate Economics), ADEME (the French environment and energy agency) and SNCF, France's national state-owned railway company. It intends to improve our understanding of how large organizations adapt to multifaceted changes and address wicked environmental problems. The dissertation is divided in six chapters – three of which are based on articles submitted to peer-reviewed journals[1].

The first chapter introduces the project's design, the research protocol and theoretical background rooted in qualitative analysis and *science and technology studies*. A key goal of this project was to experiment how social investigation could be carried out in very close collaboration with the subject of the observation. In this research setting, the researcher alternated periods were he was 'embedded' in the studied organization and periods of reflexive distanciation.

The second chapter presents a review of the literature on climate impacts and how they can affect infrastructures. It describes an apparent gap between a science meant to encourage large-scale actions and an adaptation that remains limited and incremental. It questions the relevance and saliency of frameworks which seek to bridge this gap and proposes an inductive inquiry as a form of reality-check.

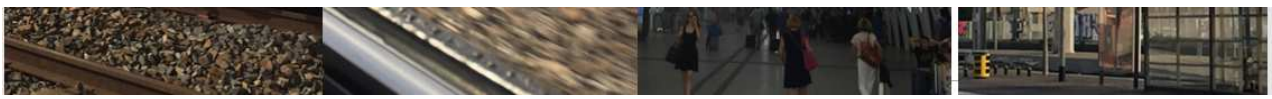
[1] *One is already published in Climatic Change (Dépoues, 2017)*

The third chapter introduces the case-study of SNCF and reports about existing initiatives directed towards adaptation in the company. It describes the drivers and limits of both corporate processes and R&D projects. According to actors interviewed in the first part of the research, adaptation is often perceived as a marginal topic, distant from strategic and operational concerns. This is why we decide – in a fourth chapter – to conduct an in-depth analysis closer to the operational concerns of the railway system. This leads to the investigation of a local sub-case study. In the region of Montpellier, climate change is a major issue for the railway system, affecting long-life projects like the design of a new line as well as the current traffic management. This system is already adapting, but in an incremental and reactive mode.

These various SNCF sites portray adaptation as it is done for now, as the negotiated outcomes of many interrelated trends and legacy pathways. The fifth chapter exposes the results of a workshop organized in Montpellier in October 2017 to go beyond this first observation. Presenting climate change as a potential rapid game-changer and focusing on variability and extreme weather event, we encouraged participants to questions SNCF procedures, doctrines and even strategic choices. The focus group has revealed the intrinsic variety of SNCF attitude towards adaptation that depends both on the activity segment (i.e., infrastructure management, high-speed, regional or commuter trains operations) and on the market structure (i.e., State run monopoly, open access markets or regulated competition). Some of the questions risen refers to governance issues **Travailler la partie articulation ct lt sites niveaux de décisions pli double boucle**

extending beyond SNCF's scope.

The concluding chapter attempts to take stock of what we described and to contribute to the organizational uptake of scientific information about climate impacts. It discusses the complementarity between various approaches, including those derived from economics to enable more anticipation. Building on the history of long-term thinking at SNCF, we defend that economic analysis might be powerful as a set of methods to combine with narrative approaches – not as device for optimization or objectivation but as a tool for exploration. Adaptation economics, we believe, is a science of governance that should help to unfold and ponder the consequences of climate change, to explore possible pathways and to create room for nurturing adaptive capacity.



Outline

Introduction

Chapter 1: An embedded research-process

Inductive approach: the theoretical background
Project design: partners, objectives, methodological choices
Research protocol
Benefits and limitations of the approach

Chapter 2: State of the art - heuristics and approaches for operational adaptation of infrastructures

A representation of climate change through climate science: *multiscale, rapid, uncertain and complex, with high stakes and impacts*

From science to decision: a post normal approach for a wicked situation?

A problematic interface
The PNS framework and associated operational approaches
Adaptation as an equivocal notion
No consensual representation of climate change - no unanimous views on adaptation

Adaptation of infrastructures to climate change: state of the art with a focus on transport and railways

Active research communities on transports adaptation and resilience
Interaction with institutional dynamics
Sectoral and corporate strategies

An ambiguous representation of the adaptation challenge

Chapter 3: studying SNCF adaptation

Presenting SNCF

SNCF Profile and organization
The French railway's network
Today SNCF's challenges
SNCF in the literature
Why to study SNCF adaptation?

Past initiatives for adaptation: the DRail project

Adaptation as an ongoing corporate policy

Norms and standards.
Vulnerability assessments
Constructing a corporate position.

Ongoing internal initiatives for resilience

Weather-service contract
Focusing on relationships between components of the railway system and weather
Studies, decision-support tools and knowledge management

Chapter 4: operating the railway system in a Mediterranean climate

Languedoc Roussillon: railway and climate, presenting the context
Great projects: designing a new high-speed line
Daily management & system resilience
Discussion on performativity and transformation capacity of the scientific discourse
Climate change between multiple legacies and ongoing changes

Chapter 5: An experimental workshop to question the implications of a more extreme and variable weather

Designing a workshop
Focusing on variability, seasonal variation and extremes
Questions raised by this focus
Discussions opened on roles distribution, responsibility and governance
A variety of potential adaptation postures – adaptation as it could be done

Chapter 6: Final discussion: adaptation, transformation, anticipation, long term and economics

Adaptation, transformation, anticipation

A field of transformation not totally problematized yet

Transformation – anticipation/long term

Describing it as a "insight" for strategy, among others

Economics

Economics at SNCF: historically & today; long term thinking; coexistence of rationalities

Uses of economics: making choices objective, taking the best decisions

Economics as an exploration science, governance

Our final statement

Complementarity figures and tales

Valuing adaptive capacity, learning

Room more than pathways

Conclusion – take home messages

How is SNCF adapting? Could it go further?
What it means for adaptation more generally?
Future research agenda.
Conclusion on the methods

Annexes and portfolio