
Climate Change Influence on Swiss Transport, Tourism and Energy - A Stakeholders Perspective

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Abstract

The European research project ToPDAd (www.topdad.eu) investigates the expected influence of climate change on the transport, tourism and energy sectors. One of the main goals is to develop adaptation strategies that stakeholders - mainly private firms and policy makers - could implement. A specifically designed tool set will assist them adapting the strategies to their individual needs.

Part of the tool set creation process were interviews with key industry representatives and experts conducted in several European countries to identify the particular needs. In selected countries, these interviews were supplemented by further surveys addressed to a wider target audience. For Switzerland, the IVT conducted six interviews covering transport and tourism, while 55 more stakeholders from all three sectors were targeted with a customized Swiss version of the online questionnaire. Additionally, 5 Swiss public transport companies were approached with a written questionnaire. This paper presents the findings of the Swiss case.

The results indicate that while companies and public agencies are aware of climate change, often in everyday business it is not a topic yet. First effects of climate change are already noticeable, for example the changes in the durations of the seasons. This causes also already first reactions in tourism for example. In general however, most stakeholders follow still an “observe and await”-strategy. For the consulted stakeholders, climate change is expected to affect their business most in the form of increased weather variability and more extreme weather events, which pose a threat to infrastructure and operations. There adaptation and protection measures are needed and expected in all sectors.

Keywords

Climate Change, Transport, Adaptation, Stakeholder, Tourism, Switzerland

1 Introduction

”Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions.” (IPCC, 2013)

The IPCC statement shows that climate change is already happening and that substantial adaptation is needed. But even if the world would substantially reduce greenhouse gas emissions today, climate change is already transforming the world we know, the Europe we know, the Switzerland we know. Rising sea levels are reshaping coast lines. Extreme weather events create havoc in formerly spared areas. Floods and droughts threaten (natural) infrastructure formerly considered reliable. The melting of the arctic ice accelerates climate change, but also starts a race to formerly unavailable resources and territories. Shorter winter and longer summer reshape tourism. (E.g. IPCC, 2013, Schweizerische Eidgenossenschaft, 2012, 2013, OcCC/ProClim, 2007)

These are just a few of the effects of climate change. These effects are already noticeable and will be felt ever stronger in the future. Governments, industry and science are required to adapt to a changing world. They are required to prepare and to take action. The question is, how to best prepare and what the optimal actions are.

Various studies investigate these important questions and try to shed some light on this pressing issue. For example on a European level the European Climate Adaptation Platform¹ provides an overview of past and current such efforts. Concrete projects on a European scale are for example some projects within the Seventh Framework Program, for example BASE² or RAMSES³. On a country level for example Klimzug⁴ in Germany or UKCIP⁵ in England. In Switzerland, different studies investigate the topic from several perspectives (e.g. Hill *et al.*, 2010, Weinhofer and Hoffmann, 2010, Finger and Calanca, 2011), while the OcCC⁶ coordinates the efforts and summarizes for the responsible policy makers (e.g. OcCC/ProClim, 2007).

The European Seventh Framework Program Project Tool-supported Policy-Development for regional Adaptation (ToPDAd⁷) is such a project. ToPDAd has the goal to support local policy and decision makers in their adaptation efforts concerning climate change. It will result in a tool which allows policy and decision makers to derive optimal adaptation strategies. ToPDAd focuses on the sectors Tourism, Energy and Transport.

¹See <http://climate-adapt.eea.europa.eu/>, accessed on April 28th, 2014.

²See <http://base-adaptation.eu/>, accessed on April 29th, 2014.

³See <http://www.ramses-cities.eu/>, accessed on April 29th, 2014.

⁴See <http://www.klimzug.de/>, accessed on April 28th, 2014.

⁵See <http://www.ukcip.org.uk/>, accessed on April 29th, 2014.

⁶See <http://www.occc.ch/>, accessed on April 28th, 2014.

⁷See <http://www.topdad.eu/>, accessed on April 28th, 2014.

As a preliminary task in ToPDAd, experts and stakeholders representing the three sectors have been interviewed and consulted in different European countries. This step guarantees the relevancy and quality of the further research in ToPDAd. In Switzerland, six face-to-face interviews with stakeholders and experts representing Tourism and Transport have been conducted. They were complemented by a written and an online questionnaire considering a wider target group.

In this paper presents the project ToPDAd as well as the Swiss stakeholders' feedbacks. Section 2 provides further background on ToPDAd, while the Sections 3 to 5 present the Swiss consultations and the according findings and embed them in the ToPDAd framework. Section 6 concludes and provides an outlook.

2 ToPDAd

2.1 A European Project

The project 'Tool-supported Policy-Development for regional Adaptation' (ToPDAd) is a EU-research project within the European Community's Seventh Framework Program. ToPDAd's total volume is 4.5 Mio. Euro. The principal goal of ToPDAd is to find the best adaptation strategies for companies and governments under consideration of the short- and longterm consequences of climate change. (Rosqvist, 2013)

ToPDAd will deliver state-of-the-art socio-economic methods and tools to support regional decision makers. The fundamental driver for regional adaptation are regional climate change scenarios. ToPDAd will provide the necessary tools for affected European stakeholders to make informed decisions on adaptation to climate change. Thus ToPDAd prevents miss-investments of time, effort and money. (Rosqvist, 2013)

The sector-specific information base for the tool set is acquired through several case themes focusing on the expected effects of climate change for different regions, different sectors (Energy, Transport and Tourism) and different scenarios.

The ToPDAd consortium consists of ten partners from eight European countries⁸. It is lead by VTT in Finland. Other partners are Alterra (Holland), Cambridge University - 4CMR (GB), CICERO (Norway), FMI (Finland), GWS (Germany), Joanneum Research (Austria), Transport & Mobility Leuven (Belgium), University of East Anglia - Climate Research Unit (GB).

⁸See <http://www.topdad.eu/partners/>, accessed on April 22nd, 2014.

2.2 Three Sectors

ToPDAd focuses on the three sectors Tourism, Energy and Transport to investigate possible impacts of climate change and to develop according strategy recommendations. In this section these three sectors are presented including for each the respective expected challenges concerning climate change. These introductions are based on ToPDAd Delivery 1.1 (Perrels *et al.*, 2013) and Delivery 2.3 (Boesch *et al.*, 2014).

2.2.1 Tourism

In ToPDAd tourism is defined as "a social and economic phenomenon which entails the movement of people to countries or places outside their usual environment for personal or business/professional purposes for a definite period of time." (Perrels *et al.*, 2013) For ToPDAd, the sector also includes first tier suppliers serving in and enabling tourism.

The major climate change related challenges to tourism are specific for the kind of tourism under investigation. For example for snow-based tourism, that is predominantly ski and nordic tourism, the major challenge is already and will increasingly be a reduced snow reliability. Another example is sun-and-beach tourism, for which the main challenge are changes in the precipitation and summer temperature patterns. New locations may become attractive and competitive, while established locations might not be able anymore to guarantee the weather patterns expected by the tourists.

2.2.2 Energy

The energy sector in ToPDAd comprises the acquisition of any kind of energy fuels, the transport of these fuels (e.g. pipelines), the generation of energy, the transport of energy (e.g. the electric grid), and the usage of the energy by an industrial, public or private user.

The major challenges of climate change are for the energy sector - as part of the adaptation process - the (expected) changes of the energy sources used and - generally - the less reliable and more extreme weather. For example alternative energy sources, such as wind, solar power or biomass, are expected to have an increased share in the future energy market but are also much more weather dependent than classic energy sources and thus - ironically - much more affected by climate change. A second example for such a challenge are increasing and more extreme winter storms which pose a threat to the electric grid. More resilient grid designs are required.

2.2.3 Transport

”The transport sector encompasses all activities necessary for the planning, preparation, realization, billing and protection of the movement of people, animals and goods between distinct locations.” (Perrels *et al.*, 2013)

While transport is generally comparably resilient to climate change - today in virtually all known climate regions transport is successfully achieved and this usually on a great scale to relatively low prices - there are nevertheless some climate change based challenges to transport. For example the melting of the arctic sea ice - while being unquestionably an ecologic catastrophe with disastrous effects - is expected to cause a reorganization of international sea transport on a disruptive, global scale. Another example for challenges are expected higher summer temperatures affecting inland waterway transport and, if above certain thresholds, also railways and air transport (the flash point of kerosene is 38 °C).

3 Methodology

Section 3, *Methodology*, presents the survey, that is the interviews, the written questionnaire and the online questionnaire (Section 3.1). In Section 3.2 discusses the survey execution in more detail.

3.1 Survey Design

In ToPDAd the interviews and surveys are of an exploratory nature. The main goal was to allow the affected stakeholders to state their opinions and thus guarantee the relevancy of the work in ToPDAd, in particular of the considered case studies which serve as a database for further steps. A secondary but not less important goal was to inquire on the current state of action and adaptation concerning climate change in the respective sectors.

3.1.1 Interviews

The questions were designed for face-to-face interviews. The target audience of the interviews were public and private stakeholders representing the three sectors Energy, Tourism and Transport.

To assure a certain comparability of the interviews conducted by the different groups in the

different countries, the interview questions were designed centrally by Rosqvist (2013). The ETH-group translated the originally English questions to German because the Stakeholder interviews conducted by the ETH-group were all done in German. As the interview and the questions were not designed by the ETH-group, the design process will not be presented here. Instead focus is laid on the final product of the process which is the questionnaire itself.

Interview Structure

The interviews were conducted according to the following structure:

- *Presentation of ToPDAd*: Short introduction of ToPDAd and final clarifications.
- *Influence of Climate Change*: Questions how climate change already and/or expectedly affects the stakeholder's business.
- *Gathering of Information*: Questions if and how the stakeholder informs himself about climate change.
- *Adaptation Strategies*: Discussion of possible adaptation strategies for the stakeholder's business and his sector, present relevancy of such adaptation strategies.
- *Public Efforts*: Discussion of contributions of public agencies and science, what should such efforts optimally look like, what are the stakeholder's experiences.
- *Tools*: Questions if and what tools they already use concerning climate change, what tools they would appreciate to have.
- *Case Studies*: Discussion of case studies planned in ToPDAd.

An example questionnaire can be found in appendix A. The interview was designed to take about 45 minutes. Anonymity was assured to the participating stakeholders. Following Axhausen and Weis (2010), the preliminary draft of the interview questions, which was sent out with the invitation letters, had a respondent burden of 48 points.

3.1.2 Written Questionnaire

To complement the face-to-face interviews representing the Transport sector, the interview questions were provided in form of a written questionnaire to additional, selected stakeholders. These stakeholders represented the public transport sector in Switzerland.

The questions posed in the questionnaire were the same as asked in the interviews. They were, however, prepared for a written questionnaire where they had to be self-explanatory without the guidance by an interviewer.

The questionnaire was sent to the participants by e-mail in form of an editable MS-Word-Document. Following Axhausen and Weis (2010), the written questionnaire had a respondent

burden of 165 points.

3.1.3 Online Questionnaire

In order to involve more stakeholders to participate in our survey without the additional efforts of a face-to-face interview and based on the positive feedback received in the interviews and the written questionnaire, it was decided to prepare the interview questions in form of an online questionnaire.

Google Docs^{TM,9} was chosen for the online questionnaire for its simplicity in handling and for its compatibility with written questionnaires. The ETH-group was supported by and created the questionnaire together with Transport and Mobility Leuven, represented by Christophe Heyndrickx.

The questions in the online questionnaire were based on the interview questions. Where necessary the were adapted for suitability in an online questionnaire. Also the basic structure of the interview was kept. The socio-demographic part was extended because with the online questionnaire and the optional anonymity, it was no longer clear who answered the questionnaire representing which business. Following Axhausen and Weis (2010), the online questionnaire had a respondent burden of 168 points.

3.2 Survey Execution

The ETH-group conducted its interviews from late October 2013 to early December 2013. In Switzerland, 16 stakeholders representing all three sectors, Energy, Tourism and Transport, and public as well as private businesses were approached. In mid-October, the stakeholders were asked for the interview via letter. A few days later a follow up was sent via E-Mail.

Six interviews were conducted. Five interviews were face-to-face interviews and one a phone interview. The interviewees received the questions a few days prior to the interview (for an example of the complete interview guide see Appendix A). The interviews were audio recorded and subsequently transcribed. The transcripts were presented to the interviewees and only published after according approval. The results presented in this paper are based on the approved transcripts.

The written questionnaire was sent to five Swiss public transport companies at the beginning of December. To those who did not react, a reminder was sent three working days after. The questionnaire and the reminder were both sent to the press offices of the respective companies.

⁹See: <http://www.google.com/drive/apps.html>, accessed on April 29th, 2014

The online questionnaire was available from the beginning of February 2014 until mid-April 2014. In total 55 stakeholders received an invitation for participation. Of those, 15 were targeted with a personalized invitation because of earlier contact. The targeted stakeholders represented all three sectors, Energy, Tourism and Transport, and both, public as well as private businesses.

4 Results

This section presents the results of the survey. A first subsection 4.1 gives an overview of the response rates and introduces the participants. The further subsections summarize the sector specific results of the survey, that is of the interviews, the written questionnaire and the online questionnaire (subsections 4.2 to 4.6).

4.1 Response Rates and Participants

Interviews In total 16 stakeholders were approached for an interview. Of these 16 stakeholders, 11 (69%) reacted and with 6 (38%) an interview could be organized. Of these 6 interviews, 5 were face-to-face and 1 was a phone interview. The following interviews were conducted:

USI Lugano: The interview with an expert on tourism and transport from Università della Svizzera italiana¹⁰ (USI) was conducted by phone and took place on the 30.10.2013.

SVV: The interview with a representative of the Schweizerische Versicherungsverband¹¹ (SVV) was a face-to-face interview and took place on the 31.10.2013. The SVV is the association of the Swiss private insurance industry.

FEDRO: The interview with a representative of the Swiss Federal Roads Office¹² (FEDRO) was a face-to-face interview and took place on the 05.11.2013.

Canton Lucerne: The interview with a representative of the 'Traffic and Infrastructure' office¹³ of the Canton of Lucerne was a face-to-face interview and took place on the 06.11.2013. This office was approached for an interview because in 2005 Central Switzerland and the Canton of Lucerne in particular, suffered from major floods.

STF: The interview with a representative of the Swiss Tourism Federation¹⁴ (STF) was a face-to-face interview and took place on the 19.11.2013. The STF is the representative organization of the Swiss tourism industry.

¹⁰See: <http://www.usi.ch/>, accessed on April 23rd, 2014

¹¹See: <http://www.svv.ch/>, accessed on April 23rd, 2014

¹²See: <http://www.astra.admin.ch/>, accessed on April 23rd, 2014

¹³See: <http://www.vif.lu.ch/>, accessed on April 23rd, 2014

¹⁴See: <http://www.swisstourfed.ch/>, accessed on April 23rd, 2014

SBB: The interview with a representative of the Swiss Federal Railways¹⁵ (SBB) was a face-to-face interview and took place on the 06.12.2013.

Written Questionnaire In total 5 Swiss public transport companies were approached with a written questionnaire. All 5 reacted and 4 (80%) returned an answered questionnaire. The participating companies were the Appenzeller Bahnen¹⁶ (AB), PostBus Switzerland¹⁷, Rhaetian Railway¹⁸ (RhB) and the Swiss Südostbahn¹⁹ (SOB).

Online Questionnaire In total 55 stakeholders were approached with an invitation to participate in the online questionnaire. Of these, 10 (18%) participated. Of the 15 of these 55 stakeholders who were targeted with a personalized invitation, 6 (40%) reacted and 4 (27%) answered the questionnaire. Due to the optional anonymity of the participants however, the response rate of the personalized invitations could be higher.

Of the 10 participants in the online survey, 5 represent regional public agencies with activities in general administration (2), environment (2) and transport (1). One represents a national civil protection agency. Two participants represent business associations from the sectors transport and tourism. One participant represents a medium sized business in tourism and one a large insurance company.

Respondent Burdens Fig. 1 shows the response rates relative to the respondent burdens calculated by following Axhausen and Weis (2010).

4.2 Tourism

Database Interviews and questionnaire results representing the Tourism sector are the interviews with USI and STF plus one medium sized business and one business association which participated in the online survey.

Influence of Climate Change On tourism, climate change is likely to have two different kinds of major influences. First, global warming influences any snow based tourism and summer

¹⁵See: <http://www.sbb.ch/>, accessed on April 23rd, 2014

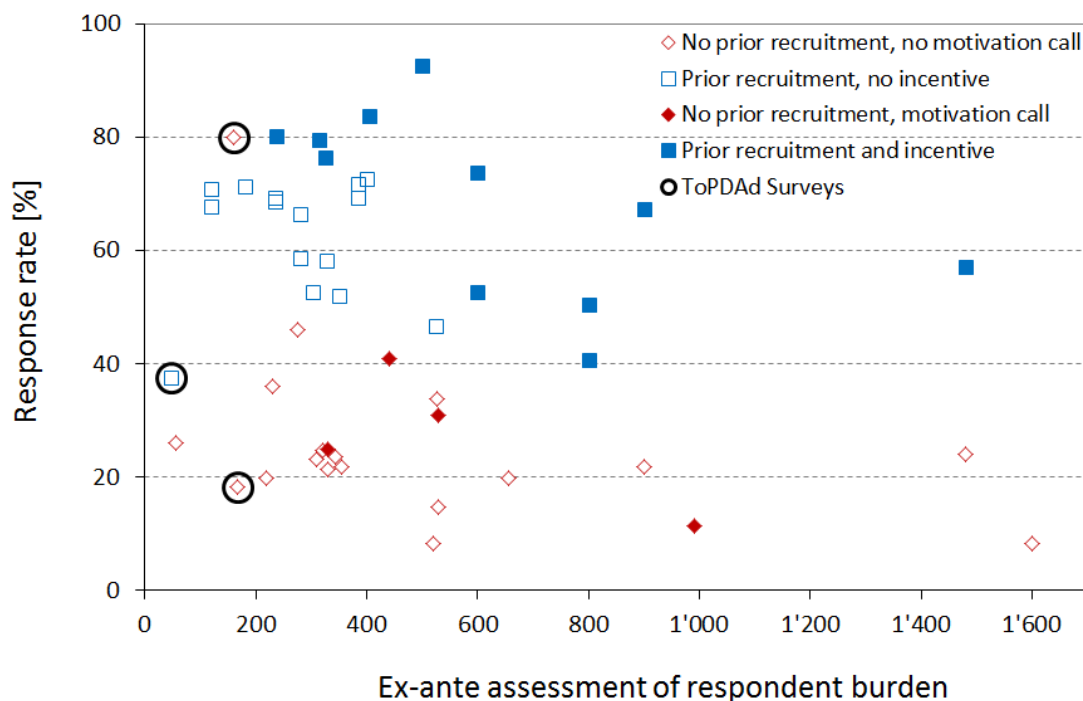
¹⁶See: <http://www.appenzellerbahnen.ch/>, accessed on April 23rd, 2014

¹⁷See: <http://www.postauto.ch/>, accessed on April 23rd, 2014

¹⁸See: <http://www.rhb.ch/>, accessed on April 23rd, 2014

¹⁹See: <http://www.sob.ch/>, accessed on April 23rd, 2014

Figure 1: Response rate versus respondent burden. Base graph from Axhausen and Weis (2010). Values from Swiss ToPDAd survey added (Interviews: 48/37.5% , Written Questionnaire: 165/80% , Online Questionnaire: 168/18.2%).



Source: Adapted from Axhausen and Weis (2010)

tourism. Second, increased weather variability influences group tourism and virtually any weather oriented tourism.

Global warming is likely to rise the average snow line and to cause shorter, less intense winters. Already now this - combined with other reasons - causes a correction in the market. Bigger ski areas grow and consolidate. Smaller areas and areas of low altitudes (majority of slopes below 2000m above sea level) are disappearing. The remaining areas need and already do strengthen their summer tourism. There global warming poses a chance for these areas as they can offer relief from the summer heat in the lowlands. These new offerings in summer tourism will likely affect the established 'sun and beach'-areas. Previously too cold areas in central and northern Europe are able to offer 'sun and beach'-alternatives, allowing the people to enjoy summer tourism with much shorter travel distances.

The increased variability in weather can cause tour operators organizing group tourism to search for alternatives: "As I said, it is quite possible that the tour operators from the Far East or from overseas will adjust their tour when it does not work out for a few times. And one realizes, once they are gone, it becomes very difficult to get them back again." (Swiss Tourism Federation,

2013)

Information Concerning information on climate change in tourism, apparently, only few is available on an ‘everyday life’-level yet. There are, however, conferences and publications on climate change already and the stakeholders are interested in this information. They are interested in current research results and would like to be provided with according, prepared publications (e.g. national strategy on climate change, national information database on climate change). However, as information by governmental boards have often a political background, some issue on trust in these information is noticeable. This, in turn, offers consulting opportunities for professional and scientific advisers and boards.

Adaptation Strategy The current state on adaptation to climate change in tourism seems to be one of observation and reaction. “Tourism [...] is a reactive industry. It depends on many factors, currency fluctuations, global warming, the current weather, the global economy, which tourists come or don’t come.” (Swiss Tourism Federation, 2013) As mentioned above some adaptation is taking place already nevertheless. For example a strengthening of summer tourism and the development of new offerings, e.g. “sustainable tourism” (USI Lugano, 2013), are already observable. From the public side, some support in the development of such new, innovative offerings is available (e.g. Innotour²⁰). In general, however, climate change does not seem to be a concrete strategic issue yet in tourism. “Since one is so reactive, sometimes one just has to fight for survival and then you don’t plan for the future. Instead, you just make sure you can get by.” (Swiss Tourism Federation, 2013)

4.3 Energy

Unfortunately no private or public stakeholder representing the Swiss energy sector participated in neither the interviews nor the online survey. Upon requests for interviews the approached stakeholders refused any participation with reference to earlier, similar studies already conducted (Pfammatter, 2012, SGHL and CHy, 2011).

4.4 Transport

Database Interviewed stakeholders representing the Transport sector are the representatives of USI, FEDRO, Canton Lucerne and SBB. Additional opinions representing the Transport

²⁰See: <http://www.seco.admin.ch/innotour/>, accessed on April 29th, 2014

sector are all four answered written questionnaires and two online survey participations. The online participations are from a transport business association and from a regional transport agency.

Influence of Climate Change The survey results confirm the relative resilience of the transport sector against slow, fundamental changes in climate (see section 2.2.3). For none of the participants this was a particular, direct issue. Indirectly, though, these changes are expected to have certain influences nevertheless. For example changes in the seasonal transport demand pattern, especially for touristic regions, are expected. A second example is the expected thawing of the permafrost in the alps which will likely result in more landslides and a different water balance. A third example for such indirect effects are (already noticeable) changes in the flora, which become relevant for transport in terms of protection forests and more maintenance costs to keep streets and railway tracks plant-free.

A much stronger influence is expected from increased weather variability and extreme weather events which are expected to occur more frequently and to be more severe. They pose a threat mainly to the infrastructure. Investments are necessary to make infrastructure more weather resistant. Due to these necessary investments, to the increased expected damage to infrastructure, to the increased stress to infrastructure and to the necessary need to be ready to provide alternative transport solutions in case of a disruptive weather event, the infrastructure costs are expected to increase. Another effect of more extreme weather events is a certain loss in reliability of transport. This is particularly important for the transport of goods and logistics. In freight transport “reliability and being on time is what counts. Transport time - in contrast - is not that important.” (USI Lugano, 2013)

Effects of climate change as a social phenomenon are also noticeable. Climate change is for example a technology driver fostering research for more fuel efficient engines. Also a gradual shift in demand patterns is observable as people begin to consider “green” ideas when choosing a mode of transport.

In perspective, however, all these effects should not be overestimated, as a survey participant (RhB, 2013) pointed out: “Influences of [for example] currency exchange rates / the economy [are expected to be and also remain] significantly stronger than those of climate change.”

Information Active collection of information on climate change appears to be the exception in the transport sector at this point in time. Most stakeholders are aware of climate change and are interested if confronted with information but do not actively inform themselves on the subject. The bigger companies participate in panels (e.g. PostBus, 2013) or are in contact with according working groups (e.g. OcCC/ProClim in the case of SBB (2013)). Most stakeholders are interested in information on climate change edited by the government (e.g. a national strategy

on climate change) or science.

Particular research needs appear to be improvement of climate forecasts and, if possible, an identification of the unknown unknowns, the black swans. These are possible (systemic) effects of climate change of which we are today not even aware that we don't know them yet. These are considered to be one of the biggest threats of climate change to the transport system because it is very difficult to impossible to prepare for them. (SBB, 2013)

Adaptation Strategy The current state in adaptation in the Transport sector appears to be “assessment of risk and planning of possible measures”. The implementation of concrete measures, however, is not of particular importance yet. Three main reasons were mentioned for this cautious procedure. First, transport, particularly on the road, is a very competitive market with only small tolerance for any investments which do not pay off soon. Second, as long as the particular effects of climate change at particular spots are unknown, a general strategy of “observe and prepare” seems preferable to early implementations of protection measures. And third, as mentioned earlier, climate change pales in front of other, more important influences on the sector, like for example the general state of the economy, and is therefore not of top priority in the strategies.

4.5 Public Agencies

Database The public agencies represented by interviewed stakeholders were FEDRO and the Canton of Lucerne. In the online survey six public agencies participated representing regional and national agencies with different, climate change affected functions.

Influence of Climate Change Because of climate change and the its accompanying increased weather variability and the more extreme weather events, public agencies are required to prepare and (sometimes) to reorganize their natural hazard divisions.

Public agencies invest a lot of effort in the protection of the people from natural hazards and in the security of at least an emergency supply even in most extreme situations (e.g. major floods). These efforts are always subject to (political) discussions, however, because on the one hand the people have high, justified expectations concerning their protection, but at the same time, the cost of this protection efforts are hugely unpopular. Private protection efforts are supported and welcomed, but (so far) only voluntary.

Information The main information base on climate change for (federal) agencies is the Swiss federal strategy on climate change (Schweizerische Eidgenossenschaft, 2012) published by the Federal Office for the Environment (FOEN)²¹, but stakeholders inform themselves through other sources too. Platforms available to agencies are for example PLANAT²² and GIN²³. Some, more specialized agencies also create their own database by collecting own statistics and sometimes even by own research.

The direct contact to science is a further source of information. There the wish for recommendations on how to approach / adapt to climate change on an operational level was expressed.

Concerning the information on and warning of extreme weather events, it was explicitly stated to be careful. (Canton Lucerne, 2013) If people are lacking the background to properly read and interpret the messages, confusion is likely. For example warnings of extreme events can lead to overreactions respectively, if they persist over longer periods of time, they tend to become ignored by the public.

Adaptation Strategies The current state of adaptation to climate change is that FOEN has developed a national strategy on climate change (as mentioned above). Federal agencies orient on this strategy for their own implementations of adaptation strategies and specific guidelines. For example FEDRO (2013) is currently developing such a set of specifications for the (national) street constructors.

On a cantonal level, some pilot cantons are adapting and refining the federal strategy for their area. However, concrete measures are only few yet, if at all. The cantons are cooperating and consulting with each other. FOEN is coordinating this cooperation. (Canton Lucerne, 2013)

4.6 Insurances

Database Survey participations representing the Swiss (private) insurance industry are the interview with the representative of SSV and one participation in the online survey by a large Swiss insurance company.

Situation For Swiss insurances the most important effects of climate change are the expected increase in weather variability and the expected higher frequency of extreme weather events, especially floods and hail storms. This will lead to more damage cases, which, combined with social tendencies to an increased value density (e.g. denser building or more and more expensive

²¹See: <http://www.bafu.admin.ch/>, accessed on April 29th, 2014

²²See: <http://www.planat.ch/>, accessed on April 29th, 2014

²³See: <http://www.gin-info.ch/>, accessed on April 29th, 2014

cars), lead to higher costs. This in turn could possibly lead to less solidarity among the insured, one of the pillars of our current insurance system.

Insurance companies are currently, where suitable, (financially) supporting the implementation of damage prevention measures. A tight collaboration between FOEN and the insurance industry has recently started, with the goal to coordinate actions and to work on coherent strategies on climate-change. Additionally, research on climate-change related topics is supported and promoted.

While floods have the "biggest damage potential" (SVV, 2013), hail and hail storms are where the most need for research and for possible (warning) tools is. Also when it comes to climate change related case-studies hail storms and floods, that is extreme weather events, are at the forefront of interest.

5 Discussion

In the survey, only relatively few stakeholders participated. The 21 opinions in total are clearly not enough to make statistically representative statements. Since the interviewed stakeholders and experts were all key representatives of their field, however, to give an idea of the current state in the respective sectors is nevertheless possible.

In the written and online survey, it is - generally - not known who actually answered the questions, only what business respectively in the case of anonymous answers, what kind of business they represent. As these questionnaires served primarily as a completion of the interviews, this was acceptable.

The purpose at hand was to get an idea of the current state in the respective sectors concerning climate change and to get a professional feedback on the planned case studies in ToPDAd. For this purpose the chosen procedure of interviews with key stakeholders and experts complemented with wider survey was sufficient and probably the most resource-efficient alternative.

The response rate of the online questionnaire appears with 18.2% as low. If related to the respondent burden however, the response rates of the online questionnaire is not unexpectedly low (see Fig. 1).

In contrast, the response rate of the written questionnaire (80.0%) is exceptionally high for the chosen type of procedure and for the calculated response burden (see Fig. 1). Among other reasons, it is assumed that approaching the companies through their press offices with an individualized invitation has increased the likelihood for participation.

The response rate of the interviews is unexpectedly low for the chosen procedure of prior recruitment (see Fig. 1). One possible reason is that the chosen form of face-to-face interviews has actually a much higher respondent burden than the preliminary draft of the interview

questions lets expect. Another possible explanation is the time of year - around November - when the interviews were conducted. Having the end of the year approaching fast, late fall is usually a busy time for the companies with according low motivation of employees to participate in extra activities.

5.1 Cross-sectional Comparison

Table 1 summarizes the survey results.

Major Influences: Increased weather variability and more extreme weather events are a subject for all sectors. The potential damage to infrastructure and the disruption of operations caused by such events build the major threats.

Changing average conditions, in contrary, are for most sectors only of minor importance. The noticeable exception here is tourism, where for example already now global warming forces ski areas to consolidate and to create new offerings in summer.

Information: Generally an interest in (sector-specific) information on climate change exists. Active information gathering, however, seems still to be an exception. One reason is that only little sector specific information is available so far.

Adaptation Process: What all sectors have in common is a kind of “observe and await”-strategy toward climate change. Too few is clear yet to already invest in significant amounts. Only when investing in infrastructure and protection measures is climate change a topic already.

Summary: In summary the results of the survey indicate that climate change is a subject in all sectors. The stakeholders are generally aware of it and interested in information. Concrete measures however, are - where not part of already existing natural hazards protection programs - still an exception. Too few is known about the concrete effects of climate change to invest already. Expected effects are warmer seasons and increased weather variability. While the former is a topic primarily for tourism, the latter affects all sectors.

5.2 ToPDAd Case-Themes

In ToPDAd seven case themes build the information base from which the strategies are developed and which will underly the planned tool set (see Section 2.1). In those case themes, sector specific and cross-sectional climate change influences are analyzed and the probable effects are calculated. (Boesch *et al.*, 2014)

Table 1: Overview Survey Results

Sector	Major Influences	Information	Adaptation Process
Tourism	Shorter winter, warmer summer, increased weather variability	Interest in sector-specific information, only little information of practical relevance yet	Reactive industry, climate change often not a concrete issue in strategies yet, consolidation process in winter tourism, new offerings in summer tourism
Transport	Resilience of sector toward changing average conditions, some vulnerability to increased weather variability, increased threat to infrastructure, social phenomena (e.g. "green" mode choices)	Interest in sector-specific information, only little active information gathering yet	Measures concerning extreme weather events common, climate change often not a concrete issue in strategies yet, climate change considered when building infrastructure
Public Agencies	Protection of people and infrastructure from natural hazards and extreme weather events (floods, droughts, heat-waves, etc.)	Swiss federal strategy on climate change, interest in agency-specific information, sometimes own data-collection/research	Currently adaptation and refining of federal strategy on climate change, only few specific measures yet, implementation of protection measures from natural hazards
Insurances	Increase in weather variability and extreme weather events (floods and hail storms most important) will likely lead to increase in costs	Collaboration with and support of public agencies and science	Support in implementation of damage prevention measures

Section 5.2 presents the different ToPDAd case themes as defined in Boesch *et al.* (2014) and relates them to Switzerland via the findings of the survey.

5.2.1 Case 1 - Decreasing Snow Reliability

Decreasing snow reliability is one of the expected effects of climate change and global warming. This case theme concentrates on the ski areas and plans to put an economic value to climate change for these areas by calculating the expected change in overnight stays due to climate change.

This case is very relevant for the Swiss tourism sector as several stakeholders and experts confirmed. Ski tourism areas already now have to react on changing visitor patterns and create new offerings, e.g. in summer, to compensate for the less reliable and less profitable classical winter tourism.

5.2.2 Case 2 - Rise of Average Summer Temperatures

With climate change, summer tourism seasons are expected last longer in the Mediterranean areas and areas in northern Europe are expected to become competitive in the 'sun and beach' tourism they can offer. By calculating the expected changes in overnight stays, this case theme aims to find how the touristic flows change spatially and temporally.

In Switzerland the warmer summers might keep more people at home at the lakes instead of losing them to the beaches abroad. For the mountainous areas the warmer summers offer the opportunity for new offerings providing relief from the summer heat in the lowlands.

5.2.3 Case 3 - Impact of Arctic Ice Melting

Global warming causes the arctic ice to melt in dimensions never before experienced. While this proves disastrous for local nature and disruptive for global climate, it also offers new possibilities for international transport. In this case theme the effect of new northern transport routes on the maritime trade patterns and - indirectly - on various European countries are investigated.

For local Swiss transport providers this possible change is expected to have only minor influence. For international cargo transport, it was speculated, the demand for south-north transport through the alps might reduce.

5.2.4 Case 4 - Weather Extremes and Traffic

Increased weather variability and more weather extremes are one expected effect of climate change. Such weather extremes can have a direct (e.g. floods) or indirect (e.g. landslides) effect

on traffic. While direct cost of such events are calculated quickly and reliably, an estimation of the indirect economic loss due to disturbed traffic needs closer investigation. In this case theme such an investigation is planned for Switzerland.

Various stakeholders and experts could confirm that such a case theme is very interesting and could reveal valuable results. In the case of Switzerland, however, one has to be cautious to correctly map the different and local topographic and climatic areas in different parts of Switzerland.

5.2.5 Case 5 - Variations in Energy Production

Due to climate change, precipitation, solar irradiation, wind speed and temperature patterns are very probable to change in Europe. All these factors have an influence on energy production and consumption. The case theme investigates the expected changes in the energy sector due to these changes in weather and climate.

As no Swiss stakeholder representing the energy sector participated in the survey, in this paper this case theme is not related to Switzerland.

5.2.6 Case 6 - Effects of Flooding

Extreme precipitation events are expected to increase in Europe due to climate change. These events can result in two types of floods investigated in this case theme. First, even local and relatively short but heavy precipitation events can overload the sewage system of cities and thus cause urban floods. This will be investigated in the case of London. Second, longer and geographically larger precipitation events can cause rivers to burst their banks and to flood large areas. This will be studied on the example of the Elbe river in Germany.

As in 2005 the people in Central Switzerland had to experience, this case theme is very relevant for Switzerland. Public agencies are making huge efforts to protect the people and to prevent such events from happening. If they happen, they can cause immense damage to infrastructure and property. This affects all interviewed stakeholders, from Tourism, to Transport, to Public agencies, to Insurance companies.

5.2.7 Case 7 - Effects of protracted Droughts and Heatwaves

With climate change, the risk for the weather extreme of droughts and heatwaves is also expected to increase in Europe. In ToPDAd two effects of droughts and heatwaves are investigated. First, the cross-country, cross-sectional effect of low water levels of rivers on inland water transport

and energy production by looking at Rhine, Meuse, Rhone, Loire and Seine. Second, the local economy effect of decreased biofuel production at the example of Austria.

In Switzerland, according to the interviewed stakeholders and experts, droughts and heatwaves will have a rather low expected impact on the considered sectors. This case theme will therefore likely be of less importance for Switzerland.

6 Conclusion and Outlook

Climate change in Europe and Switzerland is a fact. (IPCC, 2013) Different precipitation patterns (Canton Lucerne, 2013), milder winters (Swiss Tourism Federation, 2013) and a changing flora (SBB, 2013) can be read as first signs for the big changes ahead. Switzerland is already affected and will be more in the future (Schweizerische Eidgenossenschaft, 2012).

Local governments and businesses must consider this in their strategic planning and think of a suitable adaptation process - to minimize the impacts of negative climate change effects and to make optimal use of positive effects. Each sector faces the challenges in a different way and has to develop different approaches.

In Tourism the expected change in the duration of seasons will most likely cause demand patterns to change temporally and spatially: Already now, shorter winter and longer, hotter summer force tourism in Switzerland to react and to be innovative and offer new and different attractions.

The Transport sector is comparatively robust against changing average conditions, but the expected increase in weather variability and more extreme weather events hit the sector at its weak point - reliability and predictability. Those suppliers who can cope best with the increased uncertainty will have a competitive advantage.

Public agencies are under pressure because of climate change. People expect a reliable infrastructure and protection from natural hazards, but at the same time they also expect that these measures do not become too expensive. To find and define optimal investment in adaptation to climate change under the eyes of various stakeholders and interest groups is the challenge for public agencies.

In the insurance industry, climate change poses a threat to one of its very core principles: solidarity. An ever increasing damage potential - accentuated by climate change - can lead to costs for which even a caring society might not be willing to support everything possible anymore.

The project ToPDAd aims to provide assistance in this challenging situation. It aims to provide a tool set which local stakeholders can use for the development of adaptation strategies to climate change.

Currently in the project, the case studies representing different, relevant influences of climate

change on the sectors Tourism, Energy and Transport have been defined. Stakeholders representing these sectors have been consulted and were given the opportunity to assure relevancy of the results. The next steps in the project will be the actual execution of the planned case themes and thus, to provide a data base for further steps toward the goal of a tool set assisting local, European decision makers on their adaptation strategies to climate change.

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A Interview Guide

Adapted German translation of the ToPDAd interview guide (Rosqvist, 2013) used in the survey.

Stakeholder-Interview-Guide

Einleitung

Beginne damit, dich selbst vorzustellen und erkläre dann, dass der Grund für das Interview das Sammeln von Informationen für ToPDAd ist.

Präsentation ToPDAd

Sie sind dazu gekommen, die Unterlagen, welche ich Ihnen zukommen liess, durchzusehen?

Haben Sie noch **Fragen zum Projekt ToPDAd** oder andere Punkte, die Sie gerne besprochen hätten, bevor wir das Interview beginnen?

Das Projekt „Tool-unterstützte Policy-Entwicklung (Development) für regionale Anpassung (Adaptation)“ ToPDAd ist ein EU-Forschungsprojekt im Umfang von 4.5 Mio. Euro. Das Ziel des Projektes ist es, die besten Anpassungsstrategien für Unternehmen und Behörden zu finden im Hinblick auf die kurz- und langfristig zu erwartenden Klimaänderungen.

ToPDAd wird state-of-the-art sozio-ökonomische Methoden und Tools liefern und so in einer umfassenden Weise die regionale Entscheidungsfindung unterstützen.

Der fundamentale Treiber für regionale Anpassung sind regionale Klimaszenarien. ToPDAd wird den regionalen Entscheidungsträgern in ganz Europa die nötigen Tools zur Verfügung stellen, so dass sie informiert entscheiden können, wie sie mit dem Klimawandel umgehen sollen. ToPDAd trägt somit dazu bei, dass Fehlinvestitionen an Zeit, Energie und Geld vermieden werden können.

Das ToPDAd-Konsortium besteht aus zehn Partnern aus neun Ländern und wird vom VTT in Finland geleitet.

Über das Interview

Die Resultate werden vor einer Veröffentlichung **anonymisiert**. Nur Projektpartner werden die Protokolle der Interviews und damit allenfalls genannte Namen und Firmen sehen können.

Das Interview wird 30 bis 60 Minuten dauern.

Frage nach der **Erlaubnis, das Interview aufzeichnen** zu dürfen.

Falls aufnehmen: Ich würde ein englisches Transkript des Interviews erstellen.

Falls nicht aufnehmen: Ich würde ein englisches Protokoll des Interviews erstellen.

Sie erhalten das Transkript/Protokoll zur Durchsicht und können, falls nötig, Anpassungen vornehmen und danach würde ich dann das Dokument dem Rest des Projektteams zur Auswertung zur Verfügung stellen.

Fragen

Einfluss auf Ihre Tätigkeiten

- Wie wird sich der Klimawandel generell auf Ihren Sektor auswirken? Welche negativen Auswirkungen sind zu erwarten? Gibt es auch positive Auswirkungen?
 - Auswirkungen auf das operative Geschäft in Ihrem Sektor?
 - Auswirkungen auf die Supply Chains in Ihrem Sektor?
 - Auswirkungen durch die zunehmende Variabilität des Wetters (Stichwort: Extremereignisse)?
 - Auswirkungen durch die ändernden Durchschnittswerte (Stichwort: Globale Klimaerwärmung)?
- In wie vielen Jahren rechnen Sie mit welchen *spürbaren* Konsequenzen für Ihren Sektor?
- Welche Zeithorizonte umfasst die strategische Planung in Ihrem Sektor und damit verbunden, in welcher Form ist der Klimawandel in der strategischen Planung bereits ein Thema?

Informationsbeschaffung

- Informieren Sie sich bereits aktiv über den Klimawandel?
Und falls ja, über welche Kanäle / Quellen informieren Sie sich?
- Welche Art von Informationen, welche Aspekte des Klimawandels, welche Kennzahlen sind für Sie von besonderer Wichtigkeit? Für welche Zeithorizonte?
- In welchen Bereichen / zu welchen Parametern würden Sie sich gerne mehr Informationen wünschen?

Anpassungsstrategien

- Beobachten Sie in Ihrer Branche bereits Überlegungen zu oder die Umsetzung von Anpassungsstrategien?
[Wenn nicht, bitte die folgenden Fragen im Sinne von „Wenn Anpassungsstrategien kommen, dann...“]
- Welche verschiedenen [vorstellbaren] Anpassungsstrategien gibt es in Ihrer Branche?
- Wie wird für eine der Anpassungsstrategien entschieden?
- Benötigen Sie für die Erstellung der Strategien und/oder die Entscheidung zwischen Strategiealternativen Unterstützung von aussen?
Wenn ja, ...
 - *welche Art von Unterstützung wäre das?*
 - *wann würden Sie diese Unterstützung benötigen? (Sowohl innerhalb des Strategieprozesses, als auch ganz allgemein und real im Sinne von „in wie vielen Jahren?“)*

Öffentliche Seite

- Welche Unterstützung(-massnahmen) wünschen Sie im Rahmen des Klimawandels von öffentlicher Seite, d.h. sowohl von den Behörden, als auch von der Wissenschaft?
- In wie weit ist diese Unterstützung bereits vorhanden?
- Sind Sie zufrieden mit der bereits vorhandenen Unterstützung?
- Gibt es bereits Anliegen, wie die öffentliche Seite die Unterstützung anpassen sollte?

Tools

- Welche Tools wären oder sind für Sie und Ihre Branche hilfreich im Bereich Klima / Wetter / Klimawandel?
- Gibt es bereits Tools, die Ihre Branche im Bereich Klima / Wetter / Klimawandel einsetzt?
- Könnten diese Tools als Vorbild für zu entwickelnde Tools dienen?
- Wer wäre das Zielpublikum für die Tools? Im Sinne von, wer würde die Tools vorwiegend einsetzen? Personen mit technischem Background, naturwissenschaftlichem Background, mathematischem Background oder ganz anderen Background?

Fallstudien

Um Unternehmen und Behörden Unterstützung zu bieten, werden im Projekt ToPDAd einzelne, exemplarische Fallstudien detailliert analysiert. Gerne würden wir Sie nun in der verbleibenden Zeit zur Stellungnahme zur einen oder anderen dieser Fallstudie bitten:

- Vermehrtes Über-die-Ufer-treten von Flüssen und Überschwemmungen von bewohnten Gebieten auf Grund von extremen Niederschlägen – Bedeutung für Ihren Sektor?
- Schwere Dürren und Hitzewellen in einem signifikanten Teil von Europa – Bedeutung für Ihren Sektor?