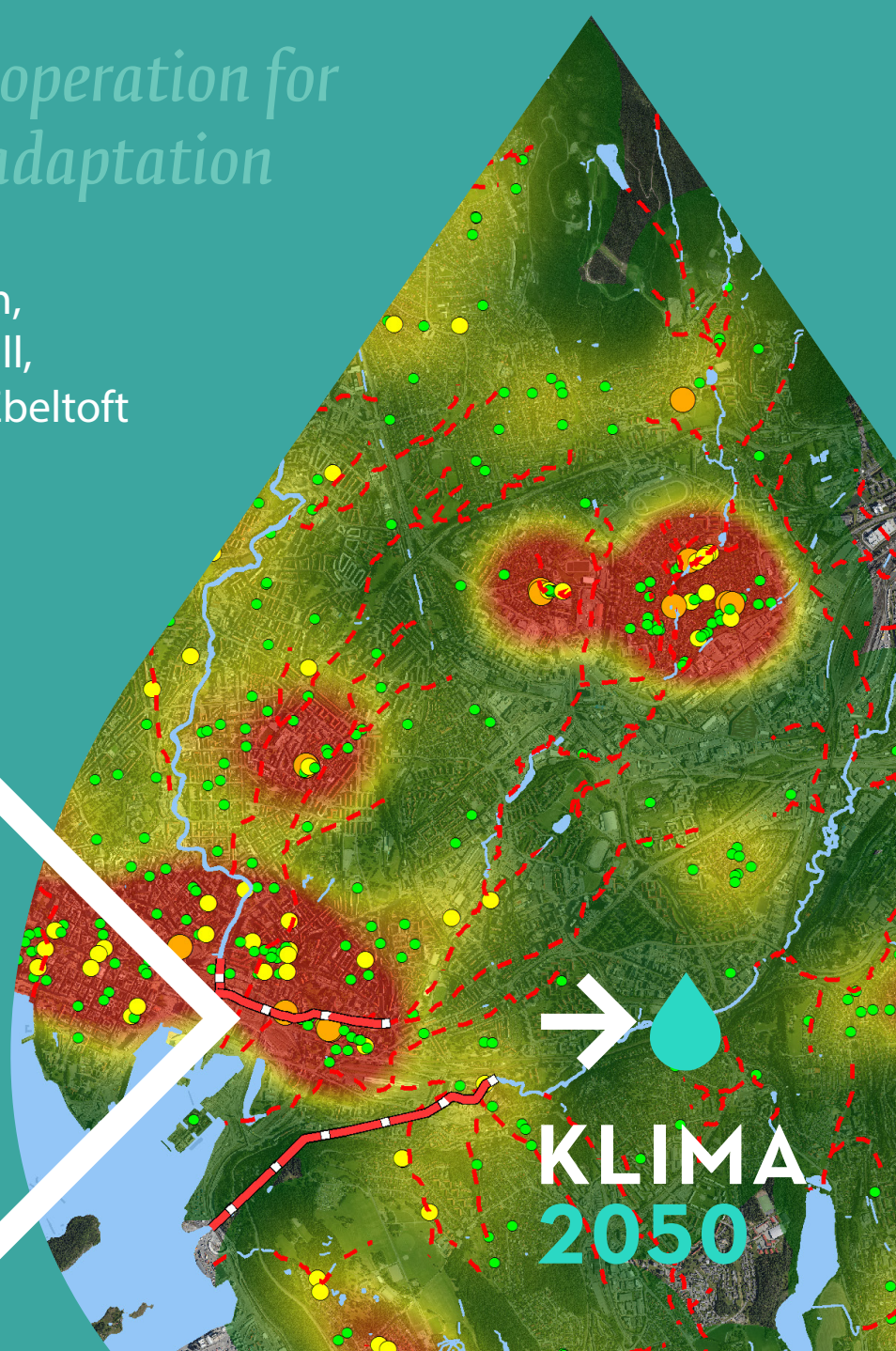


ATTITUDES IN NORWEGIAN INSURANCE COMPANIES TOWARDS SHARING LOSS DATA

*- Public-private cooperation for
improved climate adaptation*

Åshild Hauge, Cecilie Flyen,
Christoffer Venås, Carlo Aall,
Anne Kokkonen and Mia Ebeltoft



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Attitudes in Norwegian insurance companies towards sharing loss data

– Public-private cooperation for improved climate adaptation

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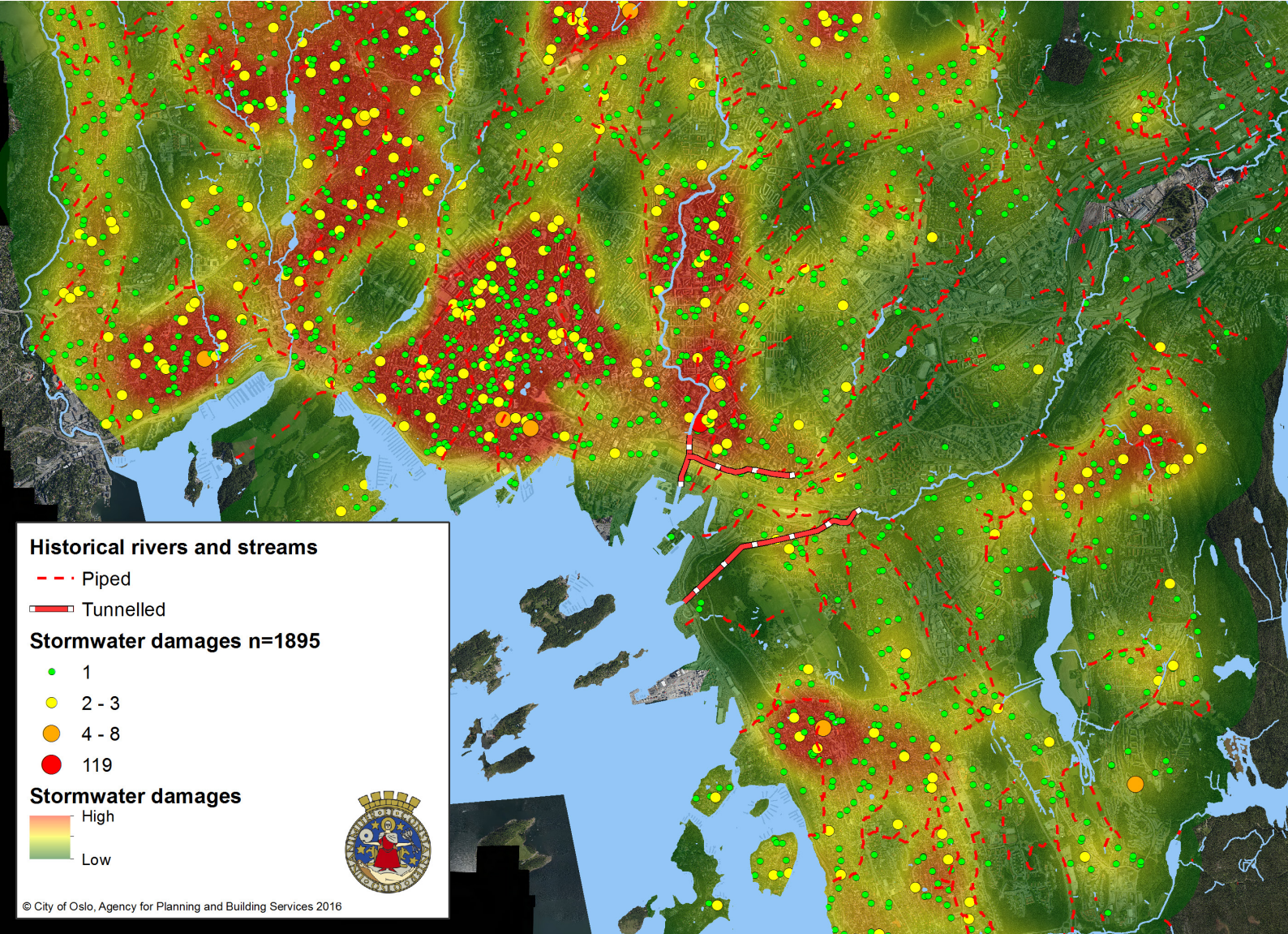
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Illustration front cover and page 3: Water damage data of Oslo from different sources:

1) Damage data from the municipality damage records (front page and page 3, topp).

2) Loss data from the insurance companies (Oslo municipality, PBE) (page 3, below).

Oslo kommune, PBE



Preface

This report presents a qualitative interview study on attitudes among leaders in the largest Norwegian insurance companies towards sharing loss data with municipalities/ public stakeholders.

Klima 2050: Risk reduction through climate adaptation of buildings and infrastructure is a Centre for Research-based Innovation (SFI), financed by the Research Council of Norway and consortium partners. Its SFI affiliation enables long-term research in close collaboration with the private and public sectors, as well as other research partners aiming to strengthen Norway's innovation ability and competitiveness within climate adaptation. The composition of the consortium is a vital factor for enabling reduction of the societal risks associated with climate change.

The Centre will strengthen companies' innovation capacity through a focus on long-term research. A further objective is to facilitate close co-operation between R&D-performing companies and prominent research groups. Emphasis will be placed on developing moisture-resilient buildings, stormwater management, blue-green solutions, measures for prevention of water-triggered landslides, socio-economic incentives and decision-making processes. Both extreme weather and gradual climate changes will be addressed.

The host institution for SFI Klima 2050 is SINTEF; the Centre is directed in cooperation with the Norwegian University of Technology and Science (NTNU). The other research partners are BI Norwegian Business School, the Norwegian Geotechnical Institute (NGI), and the Norwegian Meteorological Institute (MET Norway).

The business partners of SFI Klima 2050 represent major sectors of the Norwegian building industry, consultants, entrepreneurs and producers of construction materials and technology: Skanska Norway, Multiconsult AS, Mesterhus/Unikus, Norgeshus AS, Saint-Gobain Byggevarer AS, Skjæveland Gruppen, Isola AS and Powel AS. Also represented are important public builders and property developers: the Norwegian Directorate of Public Construction and Property (Statsbygg), the Norwegian Public Roads Administration (Statens vegvesen), the Norwegian Railway Directorate (Jernbanedirektoratet) and Avinor AS. Further key actors are Trondheim municipality, the Norwegian Water Resources and Energy Directorate (NVE) and Finance Norway.

We are especially grateful for the cooperation with Finance Norway and the Directorate for Civil Protection, and to all interviewees in the insurance companies, for the information they have provided.

Oslo, September 2018

Berit Time
Centre Director
SINTEF Byggforsk

Summary

Background and research questions

Research has shown that loss data on asset level from insurance companies have high utility value for local municipalities. These data can foster better understanding of the risks linked to nature events and surface-water flooding, in turn facilitating well-informed choices on what areas to prioritize in implementing prevention measures.

The Norwegian Directorate for Civil Protection (DSB) and Finance Norway, the organization for financial industry in Norway, co-operate in working to prevent undesirable nature events and in implementing preventive measures. DSB is developing a ‘knowledge bank’ that will compile and provide access to data on nature events and surface water flooding. The aim is to strengthen Norwegian municipalities and counties in their work on impact prevention and climate adaptation. Loss data from insurance companies are one type of data relevant for the planned knowledge bank. On this background, the research questions for the study reported here were:

1. What are the *attitudes* to sharing loss data in Norwegian insurance companies?
2. *What does it take* for insurance companies to be willing to share such data – with whom, on what level, and in what ways?
3. What *technical solutions* are required to enable sharing of loss data from insurance companies on a digital platform?

Method

The project is based on qualitative interviews in Norway’s eight largest insurance companies in Norway, two of which responded via email. We had requested interviews with the management, the head of a professional division and the IT-responsible; the companies themselves selected the informants they deemed best suited to answer the interview guide. In total, 15 informants in the insurance business have given their views.

Attitudes to sharing of loss data

- All except one of the companies say that they are willing to share their loss data on asset level, and most of them say that they are positive towards this. Some make this contingent on there being a sector-wide attitude for sharing (as seems to be the case). Most prefer there to be a *requirement* to share such data.
- Willingness to share depends on how the data are treated.
- Even if they are willing, some are sceptical to the value of sharing their loss data. They say that the problem regarding prevention measures is a question of other needs than the municipalities' need for loss data.
 - Technical personnel in the municipalities *know* what they ought to do, but they cannot get the politicians to set aside the necessary funding.
 - Municipalities already possess considerable information that they do not utilize.

What does it imply for the insurance companies to share their loss data?

Restricted admission:

- All the companies *demand* that their loss data must not be made available to other rival companies.
 - If other insurance companies had access, that might lead to price-fixing cartels and lack of competition.
 - Several companies mention fears that foreign companies would gain easy access to the Norwegian market if they could obtain such loss data.
 - Price is the most central element of competition in the insurance market. Cost-effective management and service are not enough.
- On the other hand, according to some informants, historical climate data mean less and less for setting the right prices, as climate change is making the weather more extreme than before. To

a larger extent, one must consider various climate scenarios and employ new methods for rating.

- Log-in and protection are extremely important. If too many stakeholders can obtain access to the data, it will be difficult to filter out undesirable persons. Access should be granted only to stakeholders who can utilize the loss data in prevention and climate adaptation work.
- Governmental agencies may have access; however, the main target group must be the municipalities.
- Consultants, researchers and students may have access through special arrangements that entail the obligation to maintain secrecy. According to some respondents, if the data are sufficiently aggregated, there should be no problem in giving access to outside consultants in connection with assisting the municipalities with prevention measures. One of the companies suggested that such persons could have limited access with only online viewing.

Protection of privacy:

- All companies are concerned with protection of privacy. Several of them mentioned implementation of the EU General Data Protection Regulation 2016/679 (GDPR) that entered into force in May 2018. They have difficulty in understanding that sharing personal loss data will be legal.
- This would require a legal basis, and it would require the data to be aggregated on a level where no specific individuals could be identified. Furthermore, it must also be arranged so that insurance companies are not responsible for the information after it has been delivered.
- Interviewees expect this to be resolved without the data losing value: ‘address level in, aggregated level out’. The following aggregated level for the loss data is proposed: postcode, basic circuit.
- Several of the companies noted that the purpose of data sharing must be clearly defined.
- It should not be able to identify which insurance company has provided the loss data.

Administrator of the data:

- Interviewees think the administrator should be a public, independent organization in which society has confidence: the Directorate for Civil Protection (DSB) was mentioned as one possibility. Some interviewees said that the most important point is for the organization to be able to implement an IT structure that can satisfactorily ensure security.

Arrangement:

- It will probably not be necessary to share loss data more than once a year. These should be closed cases, so that the sums are known.
- No company would demand payment for contributing to the knowledge base, unless the requirements for data quality proved too costly.
- The companies do not ask for anything in return; however, several representatives suggested that the municipalities commit themselves to preparing an action plan or to using the loss data for prevention measures. Other interviewees said that what they wanted in return was security that the data would remain protected and not made available to outsiders.

Technical changes that sharing of loss data would require

Research has shown that the municipalities need the following information: date, time, address (GIS), water level in the building, VASK code (water damage cause), amount of compensation. Can the insurance companies provide all this?

- All damage data are registered digitally.
- However, there are some challenges in providing everything that the municipalities need. Water level in buildings is not registered or is given only as text in a report. Some companies lack information on VASK code (water damage cause). Moreover, the address with holiday homes and industry customers may differ from the address where the damage actually occurred. However, map registration (GIS) is improving.

- *Most companies do not see any technical problems with registration of what is needed for reporting loss data to a public administrator; moreover, they feel that further digital development is manageable. Any missing data may easily be added.*
- All companies use In4mo for digital registration of damage and are open to the possible transfer of loss data directly from In4mo. However, there are several data companies that offer tools for handling of loss data. Administrators should not become dependent on one such firm, as insurance companies may change suppliers.
- Most companies do not see the technical/ digital demands as requiring large investments; they add that, in any case, this is the direction in which they intend to take their firm.

Conclusions and further follow-up

The study showed that 1) the largest insurance companies in Norway, representing more than 90 % of the market, are willing to share loss data with municipalities and governmental agencies working with prevention of risks and climate adaptation. They may deliver data on address level. However, 2) the output (public) data must be aggregated higher than address level: this is a clear condition. This point relates to the insurance company's responsibility for protection of privacy for its customers; finding solutions to such legal questions is up to the public authorities. Log-in and commercial sensitivity are very important for the companies: only chosen entities should be allowed access. Interviewees prefer that responsibility for sharing data is *imposed* on the companies. 3) The process of company registration of loss data appears adequately digitalized for problem-free transfer of loss data.

Klima 2050 will follow up further work with insurance loss data for climate adaptation through case studies of municipalities.

Norsk sammendrag

Bakgrunn og forskningsspørsmål

Tidligere forskning et har vist at nytteverdien av skadedata på adressenivå fra forsikringsselskapene for kommunene var høy. Dataene bidro til å forstå risikobildet bedre, og ta velinformerte valg om hvilke områder man skulle prioritere tiltak i.

DSB og Finans Norge samarbeider for å forebygge uønskede naturhendelser og bidra til forebygging. DSB utvikler 'Kunnskapsbanken' som skal sammenstille og tilgjengeliggjøre data om naturhendelser og overvannsskader for å styrke kommunenes og fylkenes arbeid med forebygging. Skadedata fra forsikringsselskapene er en av datatypene de undersøker om de kan få dele. På bakgrunn av dette er spørsmålene for denne undersøkelsen:

1. Hva er *holdningene* til deling av skadedata i de største forsikringsselskapene i Norge?
2. *Hva skal til* for at de ønsker å dele disse (tilgang), og på hvilket nivå (adressenivå)?
3. Hvilke *tekniske endringer*/ endringer i prosedyrer vil det kreve?

Metode

Prosjektet er basert på kvalitative intervju i de 8 største forsikringsselskapene i Norge, to av disse har svart skriftlig. Vi ba om intervju med ledelse, fagsjef skade og it-ansvarlig, men selskapene vurderte selv hvem som var best egnet. Totalt er det 15 informanter i forsikringsbransjen som har gitt sine synspunkter.

Holdninger til deling av skadedata

- Alle unntatt ett forsikringsselskap sier at de er villige til å dele skadedata på adressenivå, og de fleste sier at de er *positive* til det. Noen sier at det er en forutsetning at det er en bransjeholdning for deling (noe det ser ut til å være). De fleste ønsker helst at det blir gitt pålegg om det.
- Villigheten til deling vil avhenge av hvordan dataene blir håndtert.
- Selv om de er villige, er noen skeptiske til *verdien* av det. De sier at barrierene mot forebygging hovedsakelig handler om andre ting enn kommunenes behov for skadedata.
 - Fagpersonene i kommunene *vet* hva de burde gjøre, men de får ikke politikerne til å sette av penger til det.
 - Kommunene har allerede mye informasjon de ikke utnytter.

Hva skal til for at forsikringsselskapene vil dele skadedata?

Tilgangsbegrensning:

- Alle selskapene uttrykker at det er et *krav* at skadedataene ikke gjøres tilgjengelig for konkurrerende selskap.
 - Hvis andre forsikringsselskap hadde tilgang, ville det kunne føre til kartellvirksomhet og mangel på konkurranse.
 - Flere nevner redsel for at utenlandske selskaper skal kunne komme lett til i markedet hvis de får tak i skadedataene.
 - Pris er det mest sentrale konkurranseelementet. Kostnadseffektiv drift og service er ikke nok å konkurrere på.
- På den andre siden: noen sier de innser at historiske klimadata har stadig mindre å si for riktig prissetting, siden klimaendringene gjør været mer ekstremt enn før. De må i større og større grad se til framtidige klimascenarier og nye metoder for tariffing.
- Innlogging og skjerming er svært viktig. Hvis for mange aktører får tilgang til dataene, vil det bli vanskelig å hindre uvedkommende å få tilgang. Det viktigste er at de som får tilgang til data må være de som får nyttiggjort seg dette i forebyggingsarbeid.
- Statlige etater kan få tilgang, men kommunene må være hovedmålgruppen.

- Rådgivere, konsulenter, forskere og studenter kan få tilgang med spesielle avtaler og taushetsplikt. Andre sier at hvis dataene er aggregerte nok, vil de ikke være redd for å gi konsulenter som skal hjelpe kommunene tilgang. Et selskap foreslår at de kan få tilgang hvis datamengden de har tilgang til begrenses/ bare online oppslag el.lign.

Personvern:

- Alle selskapene er opptatt av personvern. Flere snakker om GDPR fra EU mai 2018. De har vanskelig for å skjønne at deling av personlige skadedata vil være lovlig.
- Det vil kreve en hjemmel, og det vil kreve at skadedataene blir aggregert til et nivå der ikke enkeltpersoner kan identifiseres. Det må også tilrettelegges slik at forsikringsselskapene ikke har ansvar for informasjonen etter et den er utlevert.
- De regner med at dette kan løses uten at skadedataene mister sin verdi; 'adressenivå inn, aggregert nivå ut.' Det er foreslått følgende aggregerte nivå: postnummer, grunnkrets.
- Flere påpeker å at formålet med datadelingen må være klart definert.
- Det bør ikke framkomme hvilke forsikringsselskap skadedataene stammer fra.

Forvalter av dataene:

- Selskapene mener at forvalter bør være en offentlig, uavhengig organisasjon som har tillit i samfunnet. DSB blir av flere anerkjent som en mulig forvalter. Noen sier at det viktigste vil være at organisasjonen får til en IT-struktur som ivaretar sikkerheten på en god måte.

Ordning:

- Det er antagelig ikke nødvendig med deling av skadedata mer enn en gang i året, det bør uansett være avsluttede saker slik at man kjenner summene.
- Ingen selskap vil kreve betaling for det. Unntaket er hvis det blir så store krav til datakvalitet at det blir kostnadskrevende.
- Selskapene ber ikke om noe tilbake, men flere foreslår at kommunene forplikter seg til å lage en handlingsplan eller faktisk å bruke dataene i skadeforebygging. Andre påpeker at det de vil ha igjen er sikkerhet for at dataene ikke kommer på avveie.

Tekniske endringer i forsikringsselskapene som deling av skadedata vil kreve

Forskning viser at kommunene trenger: dato, klokkeslett, adresse (GIS), vannstand i bygning, VASK-koding (årsaker til vannskade), erstatningsbeløp. Kan forsikringsselskapene tilby det?

- All skadedata registreres i dag digitalt.
- Men det er noen utfordringer med å tilby alt kommunene trenger: Vannstand i bygninger registreres ikke/ evt bare som tekst i takstrappreport. VASK-koding mangler hos noen. Utfordring er også at adresse på fritidsboliger og industrikunder kan være en annen enn der skaden har skjedd. Likevel, registrering i kart er i stadig bedring.
- *De fleste selskapene ser ingen tekniske problem ved registreringen av det som trengs til rapportering av skadedata til en offentlig forvalter, og ser videre digital utvikling håndterbar. De dataene som mangler kan enkelt implementeres.*
- Alle selskapene bruker In4mo for digital registrering av skade. Selskapene er åpne for evt. overføring av skadedata direkte derfra. Men flere dataselskaper enn In4mo tilbyr verktøy for håndtering av skadedata. Man må derfor ikke gjøre seg avhengig av dette firmaet, forsikringsselskapene kan bytte leverandør.
- De fleste ser ikke de tekniske/ digitale kravene som en stor investering, og sier at det er en retning de uansett vil gå i.

Konklusjoner og videre oppfølging

Undersøkelsen viser at 1) de største forsikringsselskapene i Norge, som representerer mer enn 90 % av markedet, er villige til å dele skadedata med kommuner og offentlige etater som arbeider med forebygging og klimatilpasning. De kan dele data på adressenivå. Likevel, det er 2) en klar forutsetning at 'output', de dataene som kan hentes ut, er aggregert høyere enn adressenivå. Dette henger sammen med forsikringsselskapenes ansvar for personvernet til kundene, og det er opp til

myndighetene hvordan disse juridiske spørsmålene kan løses. Det er også svært viktig med innlogging og kommersiell sensitivitet, slik at kun utvalgte instanser får tilgang. De som er intervjuet foretrekker at selskapene pålegges å dele data. 3) Prosessen med registrering av skadedata i selskapene ser ut til å være tilstrekkelig digitalisert til at evt. overføring av skadedata vil kunne gå problemfritt.

Klima 2050 vil følge opp videre arbeid med forsikringsdata for klimatilpasning gjennom casestudier av kommuner.

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1 Introduction

1.1 Background

Climate change may lead to increased risk of weather related natural hazards, such as landslides, floods and stormwater events (Hanssen-Bauer et al., 2015; IPCC, 2014). Natural hazards are most commonly linked to extreme weather events, but risks of natural hazards can also be influenced by ‘non-extreme’ weather (Aall et al., 2015). Societal change is equally important as climate change with regard to influencing the negative effects of natural hazard events. For example, the costs of natural hazards in the built environment are expected to increase due to urbanization and densification. Another example: changes in forest management may influence the risks of large-scale forest fires. Thus, both climate adaptation and prevention of natural hazards are needed. Adaptation measures should aim at reducing the exposure of society to climate-related natural hazards, as well as at increasing the capacity to deal with such events when they occur. Unfortunately, public stakeholders often evaluate vulnerability by using fragmented and incomplete data sources.

An important type of data not yet fully utilized is loss data: data on damages (on address level) that insurance companies gather concerning their customers. Such data may help municipalities and governmental organizations to deal with the hazards caused by climate change as well as damages caused by current climate conditions. Using loss data on address level requires that insurance companies can continue to safeguard the commercial aspects, and also ensure protection of personal privacy and client confidentiality. These challenges can be dealt with by regulating access to such data: who should be granted access, and how much data should be made accessible at one time.

Research in Norway has shown that the prevention of climate-related natural hazards can be strengthened if the municipalities have access to insurance companies’ loss data (Aall et al., 2017; Brevik et al., 2014; NOU, 2015). However, in order for this to happen, two major measures must be put in place: Firstly, the insurance companies must include ‘climate change adaptation’ as an additional reason for collecting loss data, and (at least in most cases) must make some changes in how the data are registered (e.g. by including terrain height for data related to flooding incidents). Secondly, an appropriate public body – for instance, the Directorate for Civil Protection (DSB) – must be provided with sufficient economic resources to establish, in close cooperation with insurance companies, a database that is accessible for the local authorities.

Climate change may require companies to consider new ways to manage their business. Statistics from Finance Norway show that nature- and stormwater damages in Norway have doubled since 2008 (Finance Norway, 2018). Climate forecasting indicates that the risk of damages will increase further (Hanssen-Bauer et al., 2015; IPCC, 2014), unless private as well as public measures are implemented. Finance Norway aims to become a driving force in climate risk reduction and is working to establish incentives for climate adaptation. In February 2018, the DSB and Finance Norway entered into formal cooperation aimed, *inter alia*, at preventing natural hazard events.¹ Based on this cooperation, work on establishing a national database on damage data (‘Kunnskapsbanken’) also started in 2018, involving the insurance agency Norsk Naturskadepool in addition to DSB and Finance Norway.²

A Finance Norway pilot project (Brevik et al., 2014) showed that the utility value of loss data for the municipalities was high. This conclusion has been corroborated by a later study commissioned by the Norwegian Environment Agency (Aall et al., 2017). Municipalities could understand the risks better, be more aware, and have a better basis for deciding what areas to prioritize for technical measures. The ‘Kunnskapsbanken’ project aims to compile and make available data for civil protection to assist municipalities and county administrators in their work on preventing nature events through a better knowledge base for cost–benefit analysis, risk and vulnerability analysis. Insurance data on address

¹ <https://www.finansnorge.no/aktuelt/nyheter/2018/02/samarbeid-om-klimakonsekvenser/>

² <https://www.dsb.no/nyhetsarkiv/nyheter-2018/klimasamarbeid/>

level are among the data that DSB wishes to collect and make available. Other relevant data providers include the Norwegian Meteorological Institute (MET), the Norwegian Public Roads Administration (SVV) and the Norwegian Water Resources and Energy Directorate (NVE).

Klima 2050 (www.klima2050.no) has conducted a research study to find whether insurance companies are willing to share geo-referenced loss data, and what they need to be able to contribute.

1.2 Aims and target group

This research examined opportunities for cooperation between insurance companies and public stakeholders in working for climate-change adaptation. The focus was on attitudes among leaders of insurance companies to sharing loss data, and how this might affect their business.

The study has explored the possibilities and barriers involved in utilizing insurance loss data for climate adaptation, by investigating the willingness of insurance companies to share such data. The research questions were as follows:

1. What are the *attitudes* to sharing loss data in Norwegian insurance companies?
2. *What does it take* for insurance companies to be willing to share such data – with whom, on what level, and in what ways?
3. What *technical solutions* are required to enable sharing of loss data from insurance companies on a digital platform?

The authors conducted qualitative interviews with insurance company managers, asking about sharing loss data with public stakeholders working with climate adaptation in the built environment.

The target groups were insurance companies, reinsurance companies, municipalities, governmental authorities and organizations, in Norway and abroad.

Limitations of the study:

The study focuses on loss data from *private* insurance. It does not go into depth concerning insurance for municipalities or public properties.

The research questions could have been studied also from the angle of reinsurance companies, the international re-insurer companies (e.g. Munich Re insurance, Swiss Re insurance). There has not been time and budget for this type of extension of the project.

1.3 Explanation of concepts and stakeholders

Loss data: There is no official definition of ‘loss data’. However, ‘loss’ is defined as follows in a glossary of insurance terms developed by the US National Association of Insurance Commissioners:³ ‘Physical damage to property or bodily injury, including loss of use or loss of income’. Thus, a derived definition of *loss data* could be: Data on physical damage to property or bodily injury, including loss of use or loss of income.

Natural hazards: A widely accepted definition characterizes natural hazards as ‘those elements of the physical environment, harmful to man and caused by forces extraneous to him’ (Burton et al., 1978).

Climate damages: Natural hazards caused directly or indirectly by climatic conditions. Romieu et al. (2010) notes a problem related to the use of the term ‘hazard’: this is often seen as a gradual change by the climate change community, but as a sudden shock by the natural hazards community. Thus, gradual changes may easily be overlooked in a climate and natural hazards context, even if they

³ https://www.naic.org/consumer_glossary.htm#L

involve increased risk of abrupt and damaging incidents. It is important to stress that climate damage includes natural hazards caused by both abrupt and gradual climatic conditions.

Extreme weather events: Natural hazards are most commonly linked to abrupt climatic impulses often referred to as ‘extreme weather events’. The Norwegian Met office has defined extreme weather events as follows (our translation):⁴ ‘Wind or precipitation is so strong, the expected sea level so high or the risk of avalanches is so high that life and considerable economic values are at stake unless society is specifically prepared for the situation. Moreover, the weather affects a large area.’

Surface water flooding (SWF): SWF represents a combination of pluvial flooding (triggered by accumulated rainfall resulting in overland water flow and ponding that cannot be drained away), stormwater flooding, sewer flooding, flooding from small open-channel and culverted watercourses, and overland flows from groundwater springs (Bernet et al., 2017; Gradeci et al., 2019).

Climate change: ‘A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods’ (as defined in the United Nations Framework Convention on Climate Change: UNFCCC). It is important to stress that changes in both extreme and ‘non-extreme weather is of importance in relation to natural hazards (Aall et al., 2015). An increase in average temperature and the average level of precipitation can increase the risk of rot decay in wooden infrastructure – which in turn may increase the risk of damage due to extreme weather events. Furthermore, lock-in weather situations – e.g. extreme long periods with ‘non-extreme’ levels of precipitation – can increase the risks of landslides.

Climate change adaptation: ‘Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities’ (as defined by The Intergovernmental Panel on Climate Change: IPCC)⁵. Furthermore, the IPCC distinguishes six versions of climate change adaptation:

- Anticipatory Adaptation: Adaptation that takes place before impacts of climate change are observed. Also referred to as ‘proactive adaptation’.
- Autonomous Adaptation: Adaptation that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems. Also referred to as ‘spontaneous adaptation’.
- Planned Adaptation: Adaptation that is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state.
- Private Adaptation: Adaptation that is initiated and implemented by individuals, households or private companies. Private adaptation is usually in the actor's rational self-interest.
- Public Adaptation: Adaptation that is initiated and implemented by governments at all levels. Public adaptation is usually directed at collective needs.
- Reactive Adaptation: Adaptation that takes place after impacts of climate change have been observed.

Finance Norway: Finance Norway is the industry organization for the financial industry in Norway. It represents 240 financial companies with 50,000 employees and advocates the views of the industry towards various groups in Norwegian society: politicians, government, the consumer authorities, international collaborators and decision-makers and consumers.⁶

General Insurance's Non-Life Board (Bransjestyret Risiko og Skade) consists of CEOs or similar from the main insurance companies. A part of their agenda since 2010 has been dedicated to leverage the understanding of climate risk and to work for better legal, economic and technical incentives for

⁴ <http://www.yr.no/artikkel/kan-bli-ekstremvaer-1.11092802>

⁵ <http://www.ipcc.ch/ipccreports/tar/wg2/index.php?idp=689>

⁶ <https://www.finansnorge.no/en/about-finance-norway2/>

reducing climate risk and hindering the rise in climate-related losses. A Climate Change Committee (Fagutvalg Klima) reporting to the Board, with members from the insurance companies, was established in 2010. The committee has been an important factor for establishing a climate-change adaptation strategy and anchorage within the companies as regards understanding and working on climate-related issues – particularly the pilot project on sharing local loss insurance data with municipalities. In 2010 Finance Norway began setting up workshops to connect and discuss with various authorities, researchers and municipalities what was at risk and how to find a more holistic approach to climate change and disaster risk reduction. Several joint projects and activities also resulted from this activity. Further, the authorities included Finance Norway in work under the EU Commission.

DSB and the ‘Knowledge bank’: DSB, the Norwegian Directorate for Civil Protection, reports to the Ministry of Justice and Public Security. Its overarching task is to maintain a full overview of various risks, and vulnerability in general. Its responsibilities cover local, regional and national preparedness and emergency planning, fire safety, electrical safety, handling and transport of hazardous substances, as well as product and consumer safety.⁷

DSB is in the process of developing a knowledge bank with data that will help the municipalities in their work on climate adaptation and prevention of nature events. The goal is to achieve better overview and knowledge about undesirable events and disasters, and thus to strengthen work on societal safety, enhance disaster prevention, and reduce losses. The project is relevant to many stakeholders. There will be a special focus on municipalities and county governors and their work on risk and vulnerability assessments. Work in the first phase focus on natural hazards. Later, it will be expanded to other types of risk.

1.4 Insurance loss data in European climate politics

Use of loss data for better decision-making in climate-change adaptation and disaster risk reduction is central to fulfilling the obligations of the *Paris Agreement*⁸ and the *Sendai Framework for Disaster Risk Reduction*.⁹ To support these agreements from the United Nations (UN), the Organisation for Economic Co-operation and Development (OECD)¹⁰ has pointed out the need for private–public co-operation, and promotes the development of technologies and expertise in monitoring and assessing disaster risks by government. The OECD emphasizes the importance of including the private sector and non-governmental organizations, the scientific and academic communities, and taking advantage of private-sector capability and expertise in the development of risk assessment and exposure models.

As per OECD Recommendation of 17 February 2017 (‘OECD Recommendation on Disaster Risk Financing Strategies’), the Ministry of Finance is recommended to (OECD, 2017):

ii) Ensure that data on assets, structural vulnerabilities, hazards and past losses necessary for the quantification of potential exposures is produced, collected, shared and made publicly available, subject to applicable confidentiality and privacy requirements.

Efforts to harmonise the collection and reporting of data nationally, regionally and internationally should be made. Post-disaster loss assessments should be completed for significant events, undertaken based on a consistent methodology and co-ordinated with the private sector, in order to support the availability of data necessary for evaluating exposures to disaster risk going forward.

⁷ <https://www.dsb.no/menyartikler/om-dsb/about-dsb/>

⁸ https://unfccc.int/sites/default/files/english_paris_agreement.pdf

⁹ https://www.unisdr.org/files/43291_sendaiframeworkfordrren.pdf

¹⁰ <http://www.oecd.org/daf/fin/insurance/OECD-Recommendation-Disaster-Risk-Financing-Strategies.pdf>

OECD (2017) further recommends establishing a strategy, under the leadership of Ministers of Finance or other relevant national authorities, to deal with the economic impacts of disasters, ensure co-operation and co-ordination across organizations in the public and private sectors, including various levels of government, with responsibilities for, and expertise in, managing the financial impacts of disaster risks, and to leverage opportunities for international co-operation.

A Science and Policy report issued by the Joint Research Centre (the in-house science service of the European Commission) on current recording of loss data in the EU member states aimed to provide evidence-based scientific support to the European policy-making process on disaster risk reduction (de Groeve et al., 2014). The authors found that an increase in extreme weather events and rapid disaster-prone economic development would contribute to an increase in casualties and economic losses due to natural hazards. The capacity of developing and developed societies to carry such losses is limited. Further, there is little awareness that estimates of future losses are hampered by low-quality historical loss data. The solution is to measure losses better. Recommendations here include sharing experience on operational data collection (local-level assessment and recording, aggregation process, uncertainty measures); exploring various tools and recently developed methods (e.g. economic loss accounting methods, sampling, remote sensing); and comparing and harmonizing different structures of loss databases and their indicators. De Groeve and colleagues note the need for further exploiting the potential of insurance as an incentive for risk reduction.

Speaking at the Insurance Europe 10th International Conference in Madrid in 2018, the European Commissioner for Climate Action and Energy, Miguel Arias Cañete, stated:¹¹

Insurers can help cities to improve their risk assessments and better define adaptation options, if they combine their knowledge of natural risks with insurance data. In countries like Austria, Denmark and Spain, farmers or homeowners exposed to high climate risks are encouraged to take local measures against climate risks. Such examples can only work if insurance is used not only after a disaster, but also in prevention, protection and early warning phases. The insurance sector has great knowledge of where extreme weather causes damage, and how costly that damage is. This knowledge should be put into practice.

The United Nations Office for Disaster Risk Reduction (UNISDR) is working on a new Global Risk Assessment Framework (GRAF) to support UN Member States seeking to reduce disaster losses through implementation of the Sendai Framework for Disaster Risk Reduction.¹² A recent GRAF expert meeting issued the following principal recommendations:

*A culture of openness should be engendered, with collective responsibility to **optimize existing data** in open support of the global public good, to realize the collective aspiration to connect systems, understand inter-dependencies and collectively identify solutions at scale.*

*Data or information on vulnerability (social and environmental) is recognized as **severely under-developed** and is recommended as a priority area for expanded work. Real reductions in risk will be through understanding and addressing patterns of vulnerability and exposure.*

The GRAF must reach the city level and the sub-local level – as development challenges including poverty and unemployment, housing, basic services all tend to be concentrated at sub-local (district) levels, where the impact and consequence of risk preventative / risk reducing action, or inaction is most keenly felt.

(The Global Risk Assessment Framework (GRAF) Better decisions for a better future Concept Note, 6.7.2018)¹³

¹¹ <https://www.youtube.com/watch?v=fSXvjhFecT0&t=3s>

¹² <https://www.unisdr.org/archive/56007>

¹³ Received through email correspondence with Whitaker, D. 04.09.2018, Final draft for expert group clearance.

In March 2018 the European Commission published its Action Plan on “Financing Sustainable Growth”¹⁴, following the recommendations of the final report by the High-Level Expert Group on Sustainable Finance¹⁵, Task Force on Climate-related Financial Disclosures (TCFD). They recognize that the financial system has a key role in addressing the challenges of climate change, and that there is a need of a comprehensive shift, aiming at reorienting private capital flows towards sustainable investments, including resilient critical infrastructure, and manage financial risks stemming from climate change foster transparency and long-termism. The insurance sector can play an important role as absorber of risk and provider of risk expertise. The TCFD-report states that the financial sector should

develop broadly accepted methodologies, datasets, and tools for scenario-based evaluation of physical risk by organizations, and

make datasets and tools publicly available and provide commonly available platforms for scenario analysis (page 40).

1.5 Insurance in Norway

Norway has a twofold compensation scheme for damages caused by defined natural perils on objects.¹⁶ Which of the schemes to be applied for compensation for the damage depends on whether the object can be insured (i.e. is suitable for fire insurance) or not. All buildings and movable property insured against fire damage are also insured against damage by natural perils, if the damage in question is not covered by other insurance (e.g. motor insurance and other forms of comprehensive insurance schemes). This follows from the Act on Natural Perils Insurance. The scheme is administered by the Norwegian Natural Perils Pool, where all insurance companies which insure the above-mentioned objects in Norway are participants. Under this scheme, compensation is ensured for damage incurred by natural perils. The Natural Perils Insurance Act does not include motor vehicles, boats, ships etc.: compensation in such cases depends on the individual annual insurance coverage specified for these items. Claims for damage to objects unsuitable for fire insurance may be compensated by the Norwegian National Fund for Natural Damage Assistance, which can provide compensation for damages to objects that cannot normally be insured against damage by natural perils by means of ordinary insurance schemes. The decisive point here is whether the object could have been insured, not whether it actually was insured.

The Norwegian Natural Perils Pool has administered this arrangement and therefore also collected loss data since 1980. Damages to private property due to pluvial flooding are also included in the property insurance. These damages, however, are not considered natural hazards, and are therefore not part of the definition of natural perils under this arrangement. Statistics collected by Finance Norway from their insurance members show that costs of pluvial flooding are about 3.5 times as much as the payment due to riverine flooding. These losses are also covered by property insurance but have been the source of increasing concern for future climate scenarios that involve more frequent heavy precipitation. Heavy precipitation leading to an increase in damages and insurance claims, timeworn water and sewage infrastructures, frustrated policyholders due to repetitive damage often in the same location and liability issues – this was becoming the normal picture. Focus and arguments around cause and liability, as well as several Norwegian Supreme Court decisions have escalated tensions between urban municipalities and property insurance companies as the cost of pluvial flooding continues to rise.¹⁷

¹⁴ https://ec.europa.eu/info/publications/180131-sustainable-finance-report_en

¹⁵ Recommendations of the Task Force on Climate-related Financial Disclosures.

<https://www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-TCFD-Report-062817.pdf>

¹⁶ <https://www.naturskade.no/en/compensation-schemes/>

¹⁷ <https://www.ibanet.org/>

In Norway, in the last ten years, insurance companies have paid annual compensation of around NOK 2 billion for damages to insured buildings caused by urban and river flooding. This represents a 114% increase from 2008 to 2017.¹⁸

Climate scenarios for Norway warn of more frequent and intense precipitation (Hanssen-Bauer et al., 2015). In Copenhagen, one rainfall in July 2011 caused DKK 6 billion (USD 1.04 billion) in damage.¹⁹ In Asker and Bærum municipalities outside Oslo, a rainfall in 2016 caused damages of more than NOK 250 million (Source: Finance Norway). The extent of damages is related to how densely the buildings are situated, non-permeable surfaces with asphalt, streams and waterways put in pipes underground, as well as poor maintenance and lack of investments in water supply and sewage (NOU, 2015; RIF, 2015). Climate changes involving more rain make the consequences greater and more expensive. The required responses are too expensive for the individual municipalities. They have almost sole responsibility for dealing with these events, in contrast to nature damages where governmental organizations will provide assistance. Another challenge for the municipalities is to know where the vulnerable areas are—and that is the type of information the insurance companies possess. In Norway the penetration of property insurance is almost 100%, making loss data even more valuable.

1.6 Review of research on loss data for Norwegian municipalities

Finance Norway's pilot project on sharing insurance loss data with municipalities (Brevik et al., 2014) showed that insurance companies have essential loss data on asset level which can improve municipal understanding of risk. Access to the natural hazards data of insurance companies was found highly useful, for smaller as well as larger municipalities. A nationwide database project could serve to boost trust and improve collaboration between municipalities and insurance companies, and within municipalities. The pilot project also showed that access to such data could provide new insights into previously unknown risks and strengthened suspicions of identified risks that had not been confirmed. It was found that data access could help in setting priorities for climate-adaptation measures in land-use planning and the construction and maintenance of water and sanitation infrastructure, and as input to municipal risk and vulnerability analyses. However, the data must include precise descriptions of when and where the damage occurred; connection to geographical tools and maps (GIS tools) is especially advantageous. Further, a common standard for reporting damages needs to be developed. Supplementary measures are also needed, such as information, attitude change, and governmental requirements, because having a database of the damage data would not in itself lead to any changes (Brevik et al., 2014).

A study by Aall et al. (2015), also published by the Western Norway Research Institute (Vestlandsforskning), investigated the profitability of prevention versus taking the cost of reconstruction after weather-related natural hazard events on physical infrastructure. Their examination of 14 municipalities in separate case studies showed that lack of (financial) resources prevented municipalities from focusing on construction to prevent damages from natural hazard events. Resources are limited to rebuilding to the same standard as before the event. The report also noted the need for a cross-sectoral national damage data register as a key measure to facilitate work on climate adaptation. Such a database is essential to enable evaluation of the profitability of prevention versus the cost of reconstruction. Further, the study investigated existing strategies for handling natural hazards in municipalities, noting the current compensation schemes do not enable municipalities to take preventive measures.

A third report (Aall et al., 2017) from the same institute describes the status of usage of loss data in the work with climate adaptation. This recent study, conducted at the request of the Norwegian

¹⁸ <https://www.finansnorge.no/statistikk/skadeforsikring/>

¹⁹ <https://www.forbes.com/sites/justingerdes/2012/10/31/what-copenhagen-can-teach-cities-about-adapting-to-climate-change/#1167f4371e89>

Environment Agency (Miljødirektoratet), investigated municipal needs for loss data. The report presents previous research in the area and an overview over existing sources of loss data. The two databases of greatest interest for municipalities were found to be those for reporting of compensation from insurance companies for water damages (Vannskadestatistikken, VASK²⁰) and natural damages statistics (Naturskadestatistikken, NASK).²¹ This report is available from Finance Norway and has previously been applied in analysing vulnerability to damages caused by water and natural hazards. According to Aall et al. (2017), these databases might serve as a good starting point for reporting of damage data, but municipalities need a higher-data quality. The damage must be correctly specified and categorized; also necessary is higher geographical resolution on the data. Today, such data are available only on the *county and municipality level*. The report includes interviews with key personnel from three municipalities that participated in the study by Brevik et al. (2014), and that have been working with damage data in climate adaptation. These interviews confirm that high geographical resolution is needed to get valuable results from damage data, whether on the address or the GPS-coordinate level. All three municipalities were large and urban municipalities; and all informants mentioned that a precondition for handling damage data from the insurance industry was a functioning geodata department in the municipality. For most municipalities in Norway, however, such competence is lacking. On the other hand, the informants generally held that if data quality is high, damage data will give possibilities to improve our knowledge about why, how and when damages occur, and to help in prioritizing the right measures. To some degree all three municipalities report the advantages of using damage data, and one informant (from Oslo) was certain that this benefit is important.

In the fourth paper of his doctoral thesis, Torgersen (2017) points out the overlooked component of household insecurity in cost–benefit analysis (CBA) of measures preventing damages from urban flooding. Contingent valuation showed that individuals experience substantial benefits from avoiding the fear and psychological stress of urban flooding. Further, Norwegians are willing to pay for preventive measures; and work for prevention of damages has social benefits beyond those of financial compensation. In a second paper, Torgersen (2017) examines the correlation between extreme rainfall and insurance claims in a case study of a specific Norwegian municipality. Principal Component Analysis was used to analyse damage data made available by the insurance companies, together with precipitation data. The aim was to find the characteristics of extreme rainfall and how it influenced the extent of urban flooding. The risk of urban water-related damages was found to peak in the late summer period, together with rainfall characteristics that could help municipalities to determine the likely level of flood risk when extreme rainfall is forecast.

In a paper evaluating flood exposure, Torgersen (2017) uses damage data from Finance Norway (the VASK register) to predict whether a property is vulnerable to flooding. Geocoded data were analysed by the Partial Least Square Regression (PLS) method. Torgersen (2017) concludes that the PLS method is a tool that could be used in setting priorities for preventive measures. His research results also support the trend of constructing more sustainable urban drainage systems (SUDS) instead of the traditional measure of upgrading pipes in the drainage system.

Torgersen's doctoral thesis (2017) shows how greater data availability and cooperation among insurance companies, municipalities and researchers can improve traditional solutions and cost–benefit analysis through the use of innovative tools and new perspectives. Thus, access to a higher-quality damage data together with more research might spur knowledge-based implementation of flexible and sustainable measures to reduce the risks of urban flooding. However, while these papers reveal important perspectives that affect municipal planning of climate risks, they do not consider municipal abilities to apply new methods in practice.

²⁰ <https://vask.finansnorge.no/>

²¹ 'Natural damage': damage directly caused by a natural event such as landslide, avalanche, storm, floods, storm surge, earthquake or volcanic eruption. <https://www.naturskade.no/en/information/act/>

Similarly, Hole (2015) in his master thesis finds that address-level access to damage data (from the VASK register) will lead to increased knowledge for the municipalities. For a case study in a specific Norwegian municipality, the student was able to obtain water damage data (on address level), in addition to known GIS data. A hot-spot analysis followed by the use of ordinary least-squares regression identified areas vulnerable to water damage. The use of damage data in advanced modelling has the potential for providing municipalities with new insights into where and why damages occur, as with the relationship between urban flooding ways and damages investigated in Hole's thesis. Sondell et al. (2019) have developed a GIS-based tool linking insurance data on surface water flooding damages, buildings and scenarios for sea level rise. The aim of the tool is to improve consequence- and risk- and vulnerability analyses in the planning processes in the municipalities.

Important work on nature damage data (the NASK register) has been performed by Rød et al. (2015). A geo-visualization tool has been developed. The ViewExposed visualization tool is a contribution to the establishment of new digital tools aimed at supporting decisions in local planning. Working on the municipal level, it offers an overview of the most vulnerable municipalities, on the basis of historical damage data. Available information is the amount of insurance compensation (in NOK) categorised over years and in four hazard types: storm, storm surge, landslide and flood. The tool seeks local involvement to add local data in addition to publicly available data from national databases. In Rød et al.'s study from 2015, the tool had not been tested in municipalities; however, there are several forthcoming journal articles in review on the continuation of the work of Rød and his colleagues on the Norwegian national natural damage database (NASK).

Work with exposure indices in ViewExposed has also been adapted in a Nordic visualisation tool, VisAdapt, aimed at homeowners (Bohman et al., 2015; Glaas et al., 2015; Johansson et al., 2017; Neset et al., 2016). Based on the users' location and house type, the tool facilitates an assessment of anticipated climate risks. VisAdapt builds on regional downscaled climate change scenarios provided by the Swedish Meteorological and Hydrological Institute (SMHI) and (flood-)risk maps provided by the Scandinavian authorities. The output from the tool is adaptation measures to the homeowners, based on guidelines collected from Scandinavian authorities, municipalities and insurance companies. The target group is not municipalities; but testing the tool on users (homeowners) showed that the downscaled climate information is a key element expected by users (Neset et al., 2016). They found the tool works as an information portal, suited for initiating discussion about adaptation measures, but that the information in the tool was on too aggregated a level. They indicate more specific information would lead to greater knowledge acquisition.

1.7 International experience with sharing of loss data

Also, outside of Norway there are some examples of cooperation between municipalities and insurance companies on use of loss data for prevention of surface-water flooding events. The Danish Insurance Association in 2016 offered all municipalities in Denmark access to cloudburst data from Danish insurers, free of charge.²² Such data are especially useful in relation to validation and improvement of risk models, but also for identification and clarification of problem areas. The Danish Insurance Association is involved in several projects aimed at supporting climate adaptation and preventing damages caused by flooding. Also, in France, within the research organization Mission Risques Naturels (MRN), researchers are working on the use of insurance data for damage prevention.²³

A systematic review article on the use of insurance data in analysis of surface water flooding events is in progress (Gradeci et al., 2019) (submitted). The review concludes that models that identify the relationship between insurance data and explaining variables may provide an insight into the occurrence of surface water flooding events. Insurance data can be applied either as monetary-based or

²² <http://www.forsikringogpension.dk/temaer/klimatilpasning/alimate/Sider/Forside.aspx>

²³ <http://www.mrn.asso.fr/publications/les-rapports-detudes/page/2/>

based on the number of claims. The number of articles published on this matter has increased since 2010. Nevertheless, only a few countries have applied insurance data for modelling surface-water flooding events; these include Canada, Denmark, France, Germany, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the UK and the USA. In some cases, only one study per country has been identified. This highlights the potential for further development (Gradeci et al., 2019).

However, such studies do not necessarily describe the challenges involved in public sharing of loss data, or the type of co-operation between insurance companies and governmental organizations. As noted by Bernet et al. (2017), damage claim records of insurance companies are a profitable data source for analysing surface-water flooding events and have been the base for several studies related to the topic. Unfortunately, insurance claim data are generally difficult to collect, as most insurance companies do not publish or provide loss data, for reasons of confidentiality. Analyses based on insurance data are impaired by spatial or temporal aggregations of the data. Insurance companies usually do not assess and record detailed information for each damage claim. It is therefore difficult to verify and differentiate the cause of each damage incident without knowing the exact location; and if the loss data are insufficient, it is difficult to model surface-water flooding events (Bernet et al., 2017; Spekkers et al., 2013).

There is a need for research on co-operation frameworks between insurance companies and governmental organizations or municipalities using loss data for climate adaptation and disaster prevention (Zhou et al., 2013). de Moel et al. (2009) point out the potential for mutually advantageous cooperation, noting that there exists some collaboration in Austria between the central government and the insurance companies regarding flood maps for awareness raising and determining insurance premiums. There has been some minor collaboration in France and the UK as well. The public monopoly insurer (for damages caused by natural hazards) in some cantons in Switzerland often have rights to participate in disaster protection and land usage planning, according to Schwarze et al. (2011). Unfortunately, the present authors have not been able to identify any research on co-operation frameworks relevant for the Norwegian case in focus here.

1.8 Business models in a changing climate

Climate change is altering the risks of damages, and accordingly the environment, also where insurance companies are acting. Climate change exacerbates the likelihood of natural hazards, such as flooding and landslides. Individuals and municipalities can prepare for these risks by insuring themselves; and insurance companies can insure themselves with reinsurance companies in case of a major natural hazard such as an earthquake. The risk of damages is central to the business of insurance companies. These risks are assessed, priced, and turned into services of security (Geneva Association, 2018). Besides the compensation money, insurance companies offer security for the future – concerning health, property, life, and liability. According to the Geneva Association (2018), there has been a paradigm shift in addressing climate-change adaptation and mitigation; traditional post-disaster financial assistance has proven ineffective and insufficient, dis-incentivising private individuals, businesses and local governments from taking proactive action to manage their risks. The insurance business is uniquely positioned for understanding the risks that climate change imposes on societies and livelihoods.

The business model of insurance companies is based on pooling the risks and the costs of damages in order to reduce the costs of an individual. While the law provides some guidelines on the work of insurance companies, pricing offers them tools to manage their products. Pricing is based on an analysis that includes multiple types of data collected by the company, for example from its customers. However, climate change may bring an heightened need for even more complex risk analysis, with the weather becoming less predictable than previously (Dlugolecki, 2008).

Insurance companies today face the risk of damages increasing and becoming more unpredictable. On the other hand, climate change can offer opportunities for new products, and digitalization offers new possibilities for interacting with customers (Nitkin et al., 2009). Climate change can be incorporated

into the business – as 60% of global insurance companies reported doing (Geneva Association, 2018). Otherwise, climate change can be included only in physical risks, as practised by 33% of the respondents among global insurance companies (ibid). Implementing climate change into the business model would concern, *inter alia*, governance, strategy, organizational risk management, and operations.

Finally, insurance companies can also aim at reducing the risks of climate change. They can offer guidance to customers, and influence suppliers and authorities (Johannsdottir, 2015). In addition, working together with governments can help to reduce the complicated risks of climate change (Geneva Association, 2018).

2 Method

2.1 Methodological approach

The findings in this study are based on qualitative interviews, with both oral and written answers. Qualitative interviewing is the best way of exploring reasons for attitudes, as it gives respondent opportunities for reflecting and discussing during the process of data collection.

The results from the study can be generalized by means of *analytical generalization*, meaning that the findings from one study can be used as a predictive guide to what may occur in other situations, given similarities in context and culture. Emphasis is thus placed on contextual information and transparency in argumentation (Brinkman & Kvale, 2014). Examples of quotations from the interviews are given in the text, so that the reader can judge the argumentation and findings.

2.2 Qualitative interviews

Each interview had a duration of about one and a half hours. Consideration was given to conducting the interviews in everyday language. Three researchers were present during most of the interviews: one for observation, one for taking notes, and one for asking the questions. After the interviews, the researchers discussed the information that had been obtained.

In the invitation for research interviews, honesty and openness in replies were requested, so that the study could help to indicate to the public authorities what to expect and how to plan when establishing the ‘knowledge bank’. All informants were ensured anonymity. The project has been reported to the Norwegian Centre for Research Data (NSD), and their guidelines for handling of interview data have been followed.

Two companies chose to answer the interview guide via email. The other interviews were conducted face to face, recorded and transcribed. All texts were thematically categorized. Themes and meanings were subsequently sorted into groups, analysed and discussed.

The results are quoted anonymously. It is not possible to find out which insurance company has which opinions, but all quotations are numbered according to the table of informants (see Table 1). This makes it possible to see what opinions have come from the same company. When working with the analysis, we selected the most typical and clear quotations were selected to illustrate the findings. Some quotations from the interviews have been simplified or slightly rephrased, however with a focus on preserving the meaning of the statements.

2.3 Informants

Interviewees were managers and technical staff from the eight largest insurance companies in Norway (see Table 1). Six interviews were conducted face to face, one of these with an additional written part, and another of these with one of two informants on Skype. Four interviews were with two people, one with just one person. As noted, two of the companies answered the questionnaire via email. Eight companies were interviewed in total, 15 informants altogether, most of them male.

Table 1: Study informants, Norwegian insurance companies

Insurance company	Date of interview	Number of informants	Oral or written answers
1	13.04.2018	2	Oral
2	9.04.2018	2	Oral
3	12.04.2018	2	Oral
4	10.04.2018	1 (+1 via email)	Oral + written part
5	24.05.2018	2	Written
6	22.03.2018	2	Oral
7	02.05.2018	1	Written
8	13.04.2018	2	Oral

3 Results and discussion

3.1 The role of insurance companies in prevention of nature events

Understanding of municipal needs

Interviewees from insurance companies were asked about their understanding of the usefulness of loss data to municipalities. Most interviewees stated that they had some knowledge on what the municipalities need as regards loss data, and they confirmed that this would supplement the risk picture and help the municipalities to prevent nature hazards.

We feel that we do have an understanding of this matter. And that information that the insurance companies have, like loss data, this is knowledge that a municipality cannot obtain anywhere else. It can supplement the risk picture when a municipality is considering where to initiate action and take measures to limit damages or having water pipelines or sewage facilities that are robust enough to handle things. These are things that we know about, but they [the municipalities] know too little. (Company 6)

The pilot project established by Finance Norway (Brevik et al., 2014) was held up as offering insights into the meaning of loss data for the municipalities.

Interviewer: Do you know anything about what loss data the municipalities need?

Informant: Yes, we have some insight through the pilot work that was done together with Finans Norge in 2014. (Company 7)

Some interviewees note that insurance companies only have fragments, whereas the municipalities need to see the total picture. This implies that they question the value of the loss data for the municipalities:

..... we do possess fragments of information. We believe that some of it is very relevant, but a lot might not be relevant at all. I mean, some of the information you could just as easily find from map services, and from what the municipalities know from their own planning work. What they have of infrastructure and so on, they know better themselves. (Company 8)

Interviewees were also asked about their experiences with municipalities, if they felt that the municipalities take responsibility for preventing climate damages. Their replies varied according to the size and the finances of the municipality in question. The largest municipalities came out best, with Oslo, Bergen and Stavanger mentioned as examples.

Informant: There's great variation in how situations are handled, and which organizations are set up to deal with the incident that occurs. Obviously, municipalities generally wish to improve the situation. But how they handle it and to what degree they are able to do something, that varies greatly

Interviewer: Is this related to the size of the municipality, or is it more random?

Informant: Clearly, it is related to the size of the municipality and to its finances. (Company 2)

Interviewees said that some municipalities regulate land for housing in areas they know are problematic. However, interviewees also felt that some municipalities were getting better, and that the required Risk- and Vulnerability analysis have served as eyeopeners for many.

Recourse claim to the municipalities after major damages are common; however, the municipalities disclaim responsibility. It rarely happens that the municipality takes responsibility for a backlash. Many insurance companies noted that those who pay the bill should be the ones responsible for doing something about it. Otherwise, prevention would not be prioritized. Interviewees also mentioned that the nature damage pool arrangement does not offer incentives for prevention.

Social responsibility

Interviewees in most of the companies express a societal responsibility to contribute to prevention of nature damages, above their own economic interests. They also share the goal of minimizing the damages caused by nature events.

In our opinion, we do have a duty beyond our own economic interests. To contribute to prevention within... that is the responsibility that society, that Norway, has under the Paris Agreement. But there is no doubt that there are strong economic incentives for us as well. If we could reduce the damages, then that would have great significance, not only for us, but also for our customers. (Company 6)

Some companies have a sustainability strategy where this responsibility is emphasized; in some companies, there is a specific person responsible for following up these targets. These sustainability strategies appear to be fairly recent in the companies interviewed.

So, this culminated in our hiring a dedicated person responsible for sustainability. We realized that we needed a unifying person with the ability and responsibility to push us all in the right direction. The will and the interest. The strategy was there all right, but we needed to have a specifically dedicated person. When X started last year, this work picked up speed throughout the autumn. We established sustainability targets, as well as our own strategic target related to this, based on the 17 UN Sustainable Development Goals and so on. We also established a road map to keep track of where we were and should be. (Company 1)

Others say that they view societal and sustainability responsibility primarily as a governmental concern through laws and regulations, especially as regards regulations on where to build.

We see this primarily as the governments' responsibility. This has to do with regulations and the protective requirements regarding new buildings. (Company 7)

We are a private company that is in the insurance market to create profit within our enterprise. Our responsibility is limited to addressing the problems of those concerned, the relevant authority, communicating these further and channelling and if possible (...) trying to get them debated. But preventing climate change is a public responsibility, not ours (Company 8).

Insurance companies: measures for climate adaptation

Informants were asked what they did to contribute to climate adaptation and prevention of nature events. They mentioned projects conducted together with especially vulnerable municipalities. Insurance companies may contribute with advice and follow-up for municipalities asking for help. Another measure is season warnings (on weather and prevention of damage) for customers.

We also have had several joint projects with municipalities over the years. For example, in the early 2000s municipality X had a big problem with repeated urban runoff. We had close cooperation to pinpoint where they should focus their efforts to improve the storm-sewer system. (Company 4)

The companies that *insure municipalities* mentioned the damage statistics they publish on their web site as one measure of damage prevention. They were also active through insurance brokers, with advice and help for municipalities.

Other insurance companies stated that they did very little regards prevention and adaptation, and that they did not have any cooperation with municipalities.

In my experience we haven't been doing much on this matter. We focus on knowing about the risk areas regarding risk pricing, but we don't do much about prevention. (Company 7).

Interviewees were asked what they would do if a customer experienced basement flooding three times in a row. Many said that they would raise the insurance premium; some would also give advice on how to prevent new damage.

Yes, that's typical if someone has had a lot of water damage. Especially for private (customers). If the same problem occurs again, then the insurance premium will be raised, and that will be an incentive for the customer to take action. (Company 6)

Especially towards company customers, advice is given. There are no strict rules for refusing insurance in the case of recurrent type of damage: it is all based on expert assessment in each individual case. One company stated that they could not refuse to insure a customer insurance, because they were one of the biggest actors in the market. They added that basement flooding is rarely the customers' fault but is more often due to lack of municipal upgrading of the infrastructure.

The companies that insure municipalities and public buildings emphasize the tough competition. Because price matters far more than service, it is impossible to require climate adaptation or measures to prevent nature events, when selling insurance to a municipality.

Informant: Concerning tenders to the municipalities, we view it from a general perspective: the competition is tough. From a damage perspective, I've asked our sales manager several times, 'Why can't we set some requirements instead of only making an offer?' Some municipalities have outdated infrastructure, you know. But that is like withdrawing from society! It is a balancing act, it is a fine line, how you work with this. The municipalities market is very exposed to competition. There are a few companies in this market: A, B and C. They're among the most aggressive companies regarding price, and they make offers.

Interviewer: So essentially it is only price then [that you are competing on].

Informant: Yes, there are tight price demands, and this makes it hard [to set requirements] Municipalities have limited finances. And there is a limit to what we're willing to accept. That means we may withdraw quickly [from the competition]. There is underfunding [in the municipalities], so there will be a backlog. One thing is governing for the future, another thing is how to handle the existing backlog in infrastructure. (Company 8)

The companies were also asked what they would do if a municipality requested loss data on a specific date/ nature event. All replied that this had never happened. Some informants answered hypothetically that they would never provide loss data without approval from the customers/ owners. Others said they would refer to the sector organization, Finance Norway.

We don't think that is the correct way of doing it, sharing data with some municipalities that just happen to ask us. And then they would probably go and ask someone else. Things need to be more systematic. Common procedures and common norms on how to proceed, also with a view to anonymization and things like that. (Company 1)

3.2 Attitudes towards sharing of loss data

Yes to sharing of loss data

All insurance companies except one said they were willing to share their loss data, and that they were positive to doing that.

To the extent that this isn't against the law, and that the interests of our customers and our commercial are maintained, we have no objections to sharing data (Company 5)

We are interested in sharing data because we have a genuine belief in a future-oriented, sustainable society, where we are a voice in society: in the local communities and in society at large. To contribute in a wise way. For us, this will involve limiting damages and all the things that are the ideal here. Definitely. But there is also the risk of sharing of data with competitors. And there are the risks associated with protection of personal privacy, anonymization and things like that. These problems will have to be dealt with. (Company 1)

However, even if they are willing, some are sceptical to the value of sharing loss data. They say that the difficulties in prevention work have other reasons than the need for loss data. They claim that the technical staff in the municipalities know what they should do, but they cannot get the politicians to allocate the necessary funding. The municipalities already have considerable amounts of information that they do not utilize. This is backed up by recent research; guidance documents and web pages on climate adaptation are not used as much as the providers of the material had hoped (Hauge et al., 2017). Our interviewees also mentioned that Statistics Norway (SSB) has an overview of large amounts of data relevant for climate adaptation measures, like MOM figures (management, operations, maintenance), and intervals for replacement of pipelines. According to our interviewees, municipalities rarely apply these statistics. Some interviewees wondered whether there were other ways to achieve prevention of nature damages with fewer consequences for protection of privacy and the competition among insurance companies.

The question is if there are there other ways of doing this that will generate the same benefits? With less risk, fewer problems with technical issues, personal privacy, security etc., but that can generate the same benefit for the municipality or county. (Company 8)

Yes, and we would prefer for the scope to be evaluated. What is needed, what do we think will be made out it... so that we don't risk initiating something that gives a result that cannot be used for anything. (Company 3)

Importantly, the insurance companies' willingness to share loss data depends on how the data are protected.

As long as the data are treated properly, we're not sceptical to sharing loss data. It's the purpose of the sharing that determines our attitude here. If the intention is to be able to direct resources to areas that can reduce damage volumes, then it [sharing loss data] is reasonable (Company 7).

Companies were also asked about their impression of attitudes to sharing loss data in the insurance business in general. Some said that they had very little contact with other stakeholders in the insurance business, and/ or that they did not talk about that subject. Some said that they knew there had been talk about sharing loss data in the Climate Committee in Finance Norway; however, they felt that attitudes towards the matter differed.

Views differ on sharing this type of information, for the insurance companies this is sensitive information. This is the core, this is what we make money on as well. Of course, this is also sensitive for our customers, right? How it is handled is crucially important. And the information must be used only for the specific purpose and doesn't go further. Here we know that some companies have been very restrictive and reserved, but that being positive towards sharing has become the more general attitude. (Company 6)

Most of them state that a precondition for sharing loss data is a sector attitude in favour of sharing. Willingness to share would depend mainly on how the data are handled.

Business competition

All companies stressed the importance of not making the loss data available to business competitors. This is a requirement. Loss data are their ‘gold’, the ‘core of business’ ‘data are the new oil’. They make a living from predicting risk – and they fear that intruders will gain access. If loss data became a public database to which all insurance companies had access, that could easily lead to cartelization and lack of competition.

The insurance industry – it’s a game between the companies, to be best in predicting damages. And since historical loss data are a very important parameter for predicting who will get damages, we, as a big company, don’t want to share this with many small ones. This is a crucial point for us whenever we share data, that the information does not fall into the hands of our competitors. But apart from that we’re always positive to sharing information that can generate benefits for society. (Company 4)

Several companies also feared that international companies could gain easy access to the market if they obtained the loss data.

It would be very easy for an international company just to take all this information and start up a new company in Norway in no time. All of this for free. This is something we have spent very many years, and a lot of money and energy, in establishing. In many ways this is our equity capital. (Company 6)

They explained that they were in favour of free competition; however, no company should get easier market access than others. They are worried about an overly complex competition situation. Bigger insurance companies will have more to lose if the loss data should fall in the wrong hands. Small companies would be very happy to get hold of these figures.

So, it is the top of the class, the four biggest that have most to lose here. In general, it is the largest companies in the Norwegian market that have a well-established environment and resources for analysing data that makes good evaluations. When it comes to risks and these types of evaluations, it is the converse for the small and new companies. (Company 1)

On the other hand, some informants said that historical data now mean less and less for correct price-setting: climate changes are making the weather more extreme than before, so they now look more to future climate scenarios and new methods for rating.

In general, it can be said that the loss data are ‘the gold’ of the companies. However, we realize that our own loss data are worth less than before, since new rating methods are introduced more and more often. (Company 7)

Most informants did not feel there should be a requirement about sharing loss data, applicable to all companies. Others said that the most important thing was for the largest companies to join this arrangement. To ensure a sufficiently good database, all the major insurance companies would have to be included, as these often have different geographical main points.

Informant: We are generally positive. But that requires of course that we are not alone, there must be a sector-wide attitude here. Otherwise, we’d end up sharing some data, and the others would not.

Interviewer: ... so you feel that all must share?

Informant: Yes. (Company 6)

If the database with loss data were completely open to all insurance companies, only cost-effective management and service would be left for competition. All respondents held that this would not be sufficient. Insurance premiums are the central element of competition.

When we make a tender, 80% of the tender has to do with price. Maybe two other criteria could be quality and service, but in reality, they don't count at all. (Company 3)

All companies make their own calculations of the loss data and use them to calculate risk and prices for various damage elements. They also follow trends and increases in damages closely. This is vital to all the companies interviewed: the insurance price following the loss data means everything. It is impossible to compete on service and management.

The companies differ in their portfolios, their history and methodology, and therefore understand risk differently. Although they hold that this may result in differing attitudes to sharing loss data, this study shows that they are quite in harmony on this issue.

Address level unrealistic?

Almost all interviewees felt that address level as *output* on the loss data was unrealistic because of protection of personal privacy but added that they might deliver the data on address level (as *input*). Further, they wanted the data to be aggregated before making the information available to stakeholders working with climate adaptation and prevention of nature events.

When address is registered, the data are not anonymous anymore. You can find out who lives in that specific house. All this will have to be done in accordance with the regulations on privacy. There is a lot of personal information being distributed already, so this will not necessarily be a problem. But there must be legal backing. Without provision from the government, I think that even if the Data Protection Agency agreed, this has [previously] been only a restricted pilot project, with a specific purpose. If you want to systemize this and keep on publishing all these [loss] data, perhaps many municipal employees will get access: then there will be large-scale large distribution of this personal information, far removed from the [initial] purpose when the customer was contacted and provided this information. It is very important to look into this. If the authorities want something, they will make provisions for it. But I don't think that it will be so easy to implement this. This aspect should be taken very seriously. (Company 3)

A main finding in Aall et al. (2017); Brevik et al. (2014) is that the loss data *must be* on address level to be of use for the municipalities. The loss data also must be described precisely and connected to GIS. It is up to the public authorities to consider the societal value of releasing the insurance companies from the responsibility to protect their customers' privacy in relation to municipal work on prevention measures.

Companies insuring municipalities often have GPS location/ address on all the public buildings they have insured registered.

Consequences of sharing loss data in Finance Norway's pilot project 2013–2015

Many of the companies interviewed took part in the pilot project of loss data sharing in 2013–2015. None of them have experienced negative consequences from this. However, some note that they never heard of the project resulting in any specific measures on climate adaptation in the municipalities either. The project report (Brevik et al., 2014) is based on interviews about access to loss data: later follow-up on prevention measures was not within the scope of the pilot project.

I do not think it created any problems back then. But it [the pilot project] had a limited scope and time horizon. If that is the reason, or if there would not have been any consequences no matter what, we do not know. (Company 8)

Economic advantages of sharing loss data

Many interviewees held that if sharing loss data led to prevention of nature events, there would be economic advantages for all parts. It would also make the municipality better informed, and the

insurance companies would be in position to demand that the municipality act on the information available to them.

There is evidently an economic advantage for the whole industry, if we as a result of an opening like this are actually better able to anticipate where a climate crisis or a climate event may occur and lead to damages. Simply because then there will be no objects in these places, we would be able to take measures in advance. So, there will clearly be positive economical consequence both for the municipality and for the insurance companies if such results can be achieved. But I think that the path to a result like this is a bit uncertain today. (Company 2)

If we could get access to more loss data beyond our own data, that would give us advantages as regards our ratings. If the municipalities use their resources more wisely, this would benefit the company and our clients. (Company 7)

If the municipalities could obtain loss data, that would probably lead to more insurance companies offering third-party insurance for municipalities. A challenge for the municipalities is that there is a chance that there will be more recourse claims based on the information made available to the municipalities:

And if they (the municipalities) do not act, then it must be recognized that they are responsible and risk a recourse claim, so then we (the insurance companies) could demand payments if they don't do their job. Part of this will be a proposal or an option from the Parliament on this point: an objective responsibility. That could be a way of proceeding: that they can obtain these data, but in return they must 'clean up' themselves – otherwise they will have to pay through recourse claims. (Company 6)

3.3 What does it imply for the insurance companies to share loss data?

Protection of privacy - address

All interviewees spoke about protection of privacy. Many mentioned the implementation of the EU General Data Protection Regulation (GDPR) from May 2018. They have difficulties understanding that sharing personal loss data would be legal. It would have to be warranted by legislation and would require that the loss data to be aggregated to a level where no person could risk being identified. However, interviewees also felt that this is solvable without the loss data losing its value: address level in – aggregated level out.

I think that probably the largest obstacle is simply the protection of privacy. ... the possibility of just making all these data openly available. Nowadays we're very busy with ensuring existing and new rules for protection of privacy. When I was looking at this, I thought immediately, it will be necessary to establish legal warrants somehow. Will it be systemized so much that we deliver loss data with specified addresses? We haven't made any juridical assessments, but I feel this would be the main challenge. (Company 3)

Interviewees were asked if they could provide loss data on address level. Most companies may provide address level as input in a database, but do not think it is in line with the regulations on protection of privacy to make address level the *output* level. These juridical questions are up to the public authorities to decide.

Input could be GPS(-coordinate) or address level, but output will have to be something else. (Company 6)

Informants in insurance companies believe that, as output, the loss data must be less detailed – regarding how the data are visualized on the webpage. The following levels are suggested: postcode, ward, road/ street. As Aall et al. (2015) point out, loss data require high geographical resolution in order to be valuable to the municipalities. Also Hole (2015) found that address level is necessary if loss data are to be used for planning prevention measures.

Interviewees insist that the intention or purpose of data sharing must be clearly defined. Further, the arrangement must relieve the insurance companies of responsibility for the information after it has been delivered: it is the owner of the database who must assume the responsibility for handling of the data in question.

Finance Norway did get a concession from the Data Protection Agency to run the FOSS project to reduce the extent of insurance fraud [the concession will probably be withdrawn according to the new GDPR]. They are then responsible for handling these data and all companies could, without breaking the law, transfer personal data to the register. The same must apply if a new register is going to be developed, and even though the purpose is not to reduce the extent of insurance fraud but to understand the risk picture and decide what areas to prioritize different actions. It will still involve the distribution of personal information. The purpose is good, but things will have to be done correctly, and the insurance companies cannot have any responsibility for the information after it has been delivered. Then the authorities must be responsible, and the purpose of the use must be clearly defined. (Company 7)

One interviewee pointed out that the municipalities would be able to obtain various types of personal information about their residents if they got access to local loss data. In particular, information about illegally furnished basements rented out without the proper building permits would become evident due to flooding damage.

Then Norway would face an extreme housing shortage if the municipality did their job. And that they can do, if they possess all information about where and who. Why, just in Oslo, I do not know how many houses have a furnished basement illegally for rent –many, many thousands. Ten thousand probably, maybe twenty thousand. (Company 8)

Loss data administrator

Interviewees felt that the administrator of the loss data should be a public, independent organization in which society has confidence. The Norwegian Directorate for Civil Protection (DSB) was acknowledged as a potential administrator.

I have no opinion about who this should be, but it is definitely of great importance. It will have to be an organization you would trust, one that has both quality and integrity to get the data safely and according to the rules. (...) The Norwegian system is top of the class and orderly (...) It is rock solid all the way. On that point we're not very worried. But of course, you can have all the best intentions, but if you are careless with systems and routines and these kinds of things, then So it goes with having a conscious attitude and strategy as to how and who to share data with. (Company 1)

Others held that the most important asset would be an administrator with an IT-structure that could safeguard loss data properly. One insurance company mentioned Finance Norway as a possible administrator, as they would have great understanding of the competition-sensitivity of such data.

Duty to share loss data

Even if many companies were positive to sharing of loss data, most of them wanted it to be 'everyone or no one': there should be a requirement to share the data.

Interviewer: Is it important that everyone does the same? That you are required to share?

Informant: That's how I feel that it must be done like that. But there are instances when you are required to report things. For example, within damage insurance, when the authorities decided that having insurance would be made mandatory, then the companies were required to deliver statistics on this. I think that if this had been made optional back then, then the data delivered would have been of poor quality, not be complete. And how are you then going to use such information? I think it would be easy for some companies to say no (Company 3)

However, most companies said they would be willing to share their loss data without being ordered to do so. The one company that was negative to data sharing replied that they did not want to share their loss data until they have to.

Arrangement of the database

When asked how often they think the loss data should be shared, interviewees responded that it should be up to the municipalities – how often they need the data to be able to utilize it. Interviewees added that this does not have to be often, and data transfer once a year should suffice. In any case, it should be some time after a nature event, so that the compensations have been decided, and the sums known. The data transferred should concern closed cases.

It is mostly a practical matter. If we need to hire a designated person who is going to do this every day, then there will be a lot to do. That will be pretty laborious. But will this make a difference? Perhaps this is typically something that you'll have to do maybe once a year or something. Then it wouldn't require a lot of effort for us or any other companies to deliver the data. (Company 3)

None of the companies would require payment for the data, except if the demands as to data quality were so high as to make it expensive to provide the data.

Payment? That's not necessary if everyone does this [sharing loss data]. (Company 7)

However, several companies indicate that the municipalities commit themselves to actually using the data in damage prevention. Or that the municipalities pledge to make an action plan based on the data:

But then the municipalities must have committed to do something with the data. If these actions [for damage protection] are coming, we'll be willing to contribute in this work. But what are the municipalities going to do? (Company 8)

... There are many ways of getting paid for this: one could be cash, or there could be a commitment for the municipality to take action. And if the municipalities don't take action, then it must be recognized that they are responsible for a recourse claim. (Company 6)

In addition, the companies request data security in return: assurances that the data are kept protected and not made available to outsiders.

Interviewer: Are there anything else you would want in return for sharing these data?

Informant: No. Security and security, that is what counts here. (Company 4)

Who should have access?

Many public stakeholders will be interested in loss data for planning of civil protection and climate adaptation, like the Directorate of Civil Protection, the Norwegian Water Resources and Energy Directorate, Statistics Norway, Norwegian Environment Agency, or the Norwegian Public Roads Administration. Loss data would probably also be of interest to county administrators and county municipalities.

Most interviewees feel that the above-mentioned may have access but emphasize that the municipalities will be the main target group. The sharing of loss data is first and foremost intended to help the municipalities. Only one informant said:

Informant: Here [in the interview guide] you have a list of who could get access to these data. Practically everyone.

Interviewer: But then, as I understand you, the target group must only be the municipalities. But what about the municipalities that lack the expertise to utilize the data and will have to hire consultants to help them. How do you see this?

Informant: I'm not sure about that, but still, what we want to secure is how the data are used. (Company 8)

Opinion differs concerning data access for consultants and advisors in private companies. Some interviewees hold that these persons may get access through special deals and client confidentiality when helping the municipalities prevent and adapt to climate change. Others say that if the data are sufficiently aggregated, they would not be afraid to give consultants access. One interviewee suggested that they might have access if the amount of data is limited, or that access is restricted to online views, etc. This also is suggested for researchers and students: access with special permission and on condition of client confidentiality.

I don't feel a need to shield anyone, as long as we can be confident that the information does not come into the hands of outsiders who are not involved. One approach could be to forbid downloading larger amounts of data to other sources. There are various ways of handling this, and it will need to be considered carefully. For example, restricted online viewing of data is much less risky than downloading large chunks of information that can be entered into other databases. And then there are printing options, and so on. So, I think you understand what I am worried about and what must be thought through. (Company 4)

Interviewees do not want the media to have access to the database. Instead they suggest that Finance Norway or the database administrator could issue press releases on general tendencies and nature events.

When asked if there are others that should have access, interviewees say NO! If too many stakeholders get access to the data, it will be difficult to stop persons not concerned ('outsiders') from obtaining the data. People switch jobs, competences flow between companies. The most important point is that those stakeholders who get access to the loss data are the persons who intend to utilize the data in prevention measures.

... it will be problematic if the data are asymmetrically accessible in the sector. If many are to have access, it won't be possible to keep the data secret in the long run. People change jobs, and competence flows between companies. Keeping the data secret is probably not sustainable over a longer period. If there is to be open access to the data, that will call for strict requirements as to the protection of privacy (GDPR) – which in turn would make the data less interesting. (Company 7)

Therefore, *access protection and log in* are extremely important. Our informants were most worried that competing insurance companies could steal their loss data.

3.4 Technical requirements for sharing loss data

For the municipalities to be able to utilize the loss data, the following information is necessary: time and date, place (GPS/GIS) (street address, number of building, height above sea), water level in the

building, VASK code (Norwegian code system for backlash or surface water damage), amount of compensation (Aall et al., 2017; Brevik et al., 2014).

Our insurance-company interviewees were asked what procedural or technical changes would be needed to be able to deliver what the municipalities want. Indeed, there are some challenges. Water level in buildings is not registered at all companies, or only as text in assessment reports. VASK code (backlash or surface water damage) is not present in some companies. A major challenge concerns addresses for leisure homes, typically registered at the owner's main residence address.

The insurance policy address, which is given as the place of damage – if a person who lives at A has damages at cabin at B, that is often licenced at A. (Company 2)

Large industry customers may have branches across the whole country, or the world, whereas the address registered is often that of headquarters. However, our respondents note that registration connected to map/GIS is constantly improving. Height above sea level may easily be included if the loss data are connected to maps.

None of the companies foresaw technical problems with the registration of loss data, and they considered further digital developments manageable. Missing data can be inserted easily; the insurance sector uses the same loss assessors.

Actually, the system solutions that are required are already in place. (Company 6)

Some of these data are available only to a limited degree today, but the data could easily be 'washed in', for example GPS data for address or house identification numbers. (Company 7)

Insurance-companies respondents were asked how far they had come in the technological development of the registration of damage, and if they had plans for further digitalization of this process. *All state that all registration of damage is done digitally.* However, progress has been made since Finance Norway's pilot project, where this was a major challenge (Brevik et al., 2014). According to one informant, the elements the municipalities need were not necessarily accessible 10 years ago.

There is always a challenge with these things that are to be delivered, but if it is not very far off from how they did it in the pilot project, then it will typically concern some defined damages. ... This 'VASK' code system for example: you could build on that by saying that the 'VASK' code is one of the codes that should be delivered. And it is that type of code that is asked for. And you'll accept the data quality you have, even if there are sure to be some weaknesses. If we get the principal differences clarified, I do not think this will be one of the most demanding projects for us to conduct. (Company 3)

Informants in the companies that insure municipalities think that it would be natural for the administrator of the national database on loss data to contact major international reinsurance companies (e.g. Munich Re insurance, Swiss Re insurance), to learn how they work with masses of big data. These companies will know how to make reasonable systems for this type of data.

All the companies use In4mo²⁴ as a tool to register damage (with the final company currently in the process of adopting In4mo). They are open to transfer of loss data directly from In4mo. That will make Finance Norway superfluous as the connecting link. However, interviewees pointed out that there are many IT companies offering digital solutions for damage registration, and that insurance companies may change IT-solution providers. Therefore, the national administrator of the loss database should not be totally dependent on In4mo.

²⁴ <https://www.in4mo.com/>

We use In4mo as a process tool. Facts are registered in In4mo, and these are the foundation for our future processing of the damage. I see no obstacles to getting information from the database. I do not know In4mo's possibilities today for transferring predefined data, but certainly this should be possible. (Company 4)

Companies were asked about the technical development required for registering loss data in the way the authorities want: what would this cost the company in terms of competence-building, resources and investment in new digital solutions? Some said that there was a limit to what they would spend on this.

It is hard to spend large resources on this type of activity, giving it high priority. I must be honest: we are positive, but the main driver should be elsewhere, where there might be a more genuine interest for pushing this forward. (Company 4)

However, most interviewees did not see these investments as very large; regardless, that is the direction they will move in.

Interviewer: Is this an investment you will make no matter what, or are you willing to do this for the good of society?

Informant: It depends on the changes. We are continuously investing in technical solutions in order to improve the customer experience, and our societal responsibility is a part of these investments. (Company 5)

This is a part of the development of the company and will be carried out no matter what. (Company 7)

4 Conclusions

4.1 Conclusions

Drawing on qualitative interviews with 15 managerial-level informants from the largest insurance companies in Norway, the study aimed to answer these questions:

1. What are the *attitudes* to sharing loss data in Norwegian insurance companies?
2. *What does it take* for insurance companies to be willing to share these data – with whom, on what level, and in what ways?
3. What *technical solutions* are required to achieve sharing of loss data from insurance companies on a digital platform?

The study showed that 1) the largest insurance companies in Norway, representing more than 90 % of the market, are willing to share loss data with municipalities and governmental agencies working with prevention of risks and climate adaptation. They may deliver data on address level. However, it is 2) a clear condition that the output (public) data be aggregated higher than address level. This relates to the insurance company's responsibility for protection of privacy for its clients: here it is up to the public authorities how to solve these juridical questions. Other important elements are log-in and commercial sensitivity, so that only chosen entities are allowed access. Interviewees would prefer that the companies *required* to share data. 3) The process of registration of loss data in the companies appears adequately digitalized for problem-free transfer of loss data. However, all the companies are concerned about protection of privacy and safeguarding their loss data.

1) Attitudes to sharing of loss data

All except one of the companies say that they are willing to share their loss data on asset level, and most of them say that they are positive towards this. Some hold that there should be a sector-wide attitude in favour of sharing (which seems to be the case). Most would prefer a *requirement* to share the data. Willingness to share depends on how the data are treated. Even if they are willing, some interviewees are sceptical about the value. In their view, the obstacles to prevention measures mainly involve other factors than the municipalities' need for loss data. Technical personnel in the municipalities *know* what they ought to do, but they cannot get the politicians to set aside the necessary funding. The municipalities already possess considerable amounts of information that they do not utilize.

2) What does it imply for the insurance companies to share their loss data?

Restricted admission:

All the companies *demand* that the loss data not be made available to other rival companies. If other insurance companies had access, that might lead to price-fixing cartels, and lack of competition. Several companies mention fears that foreign companies will obtain easy access to the market if the loss data became available. Price is the most central element of competition in the insurance market. Cost-effective management and service is not sufficient, in today's competition. On the other, some informants note that historical climate data now mean less and less for setting the right price, as climate change is leading to more extreme weather. To a larger extent, they must now look to climate scenarios, and employ new methods for rating. Log-in and protection are extremely important. If too many stakeholders get access to the data, admission for undesirable outsiders will be difficult to prevent. The most important point is that all those who are granted access are stakeholders who can utilize the loss data in prevention and climate adaptation work. Governmental agencies may have access; however, the municipalities must be the main target group. Consultants, researchers and students may have access through special deals, on condition of maintaining secrecy. Other respondents hold that if the data are sufficiently aggregated, there should be no problems in allowing consultants access, when the intention is to assist the municipalities with prevention measures. One company suggested that consultants might have limited access, based on online-viewing only.

Protection of privacy:

All companies are concerned with protection of privacy. Several mentioned implementation of the EU's GDPR as of May 2018. They have difficulty understanding that sharing personal loss data will be legal. That would require a legal basis, and also that the data be aggregated to a level where no individuals could be identified. Insurance companies must not be held responsible for the information once it has been delivered. Interviewees expect this to be resolved without affecting the value of the loss data: 'address level in, aggregated level out'. The following aggregated level is proposed: postcode, basic circuit, street/ road. Several respondents pointed out that the purpose of data sharing must be clearly defined; moreover, it should not be possible to identify which insurance company is the source of the loss data.

Administrator of the data:

Interviewees feel that the administrator should be a public, independent organization that society has confidence in. The Norwegian Directorate for Civil Protection (DSB) has been mentioned as a possible administrator. Some respondents hold that the most important point is for the organization to implement an IT-structure that can properly ensure security.

Arrangement:

It will probably not be necessary to share loss data more than once a year. All the cases should be closed ones, where the sums are known. Further, no company said that it would demand payment to contribute – except if the requirements as to data quality proved too costly. Although the companies do not ask for anything in return, several suggested that the municipalities commit themselves to preparing an action plan or to using the loss data for prevention measures. Others said that what they

wanted in return was security assurances that the data would be kept protected and not available to undesirable outsiders.

3) Technical changes that sharing of loss data would require

The municipalities need the following information: date, time, address (GIS), water level in the building, VASK code (backlash or surface water damage), and amount of compensation. Can the insurance companies offer all this?

All damage data are registered digitally. However, water level in buildings is not registered, or only as text in a report. VASK code (water damage cause) is absent in some companies. Moreover, addresses for holiday houses and industrial customers may be different than where the damage occurred. However, map registration (GIS) is improving. *Most companies do not see any technical problems with the registration of what is needed for reporting loss data to a public administrator*, and they feel that further digital development is manageable. Any missing data can readily be added. All companies use In4mo for digital registration of damage and are open to the transfer of loss data directly from In4mo. However, there are various data companies offering tools for handling loss data. Administrators must not become totally dependent on one firm, as insurance companies may change the supplier of these services. Most respondents do not see the technical/digital demands as a large investment: moreover, they say that this is, in any case, the direction in which they intend to take their firm.

4.2 Discussion and follow-up

Previous research on sharing of loss data in Norway has shown that address-level loss data from the insurance companies has a high utility value for the municipalities. These data have contributed to an understanding of the risks linked to surface-water flooding events, which in turn may have enabled better-informed choices on what areas to prioritize in implementing prevention measures. However, the utility value of the loss data also depends on the competence level in the municipalities (Aall et al., 2017; Brevik et al., 2014).

The findings indicate that the Norwegian Directorate for Civil Protection (DSB) and Finance Norway may continue their work on including loss data in their 'Knowledge bank' (Kunnskapsbanken). Through this, municipalities obtain access to data on nature events. The insurance companies may *deliver* loss data on address level. However, address level as the *output* of the databank is more problematic, as there are unsolved issues concerning the protection of privacy. Should the greatest weight be given to considerations for the individual who owns a property that has suffered repeated damages, or the individual considering buying that property, or to societal climate adaptation?

DSB and Finance Norway must consider whether the sharing of loss data is the best way to assist the municipalities with climate adaptation and prevention measures. Many of Norway's smaller municipalities would need to build competence on how to use the loss data in planning for climate adaptation measures, or they will have to depend on outside consultants. Some interviewees from insurance companies singled out local politics as the greatest obstacle to climate adaptation measures, not the lack of information on damages. On the other hand, visualization of where damages occur, and the cost of these damages, is a powerful tool in persuading politicians to act.

Moreover: if the insurance companies provide the municipalities with detailed information on loss data, the municipalities will bear more responsibility in regress claims. The question is if small municipalities can manage such responsibility for access to loss data.

Aall et al. (2015) note that the value of the loss data depends on the combination of other relevant data held by public bodies, like access to NVE's landslide and flooding data, the Public Road Authorities' damage data, or Bane Nor's damage data. It is the total picture that could make a difference for sufficient information for climate adaptation and damage prevention. Collaboration between the public authorities and shared digital systems and databases is at least as important as collaboration between

governmental departments and private business (Flyen et al., 2016). This is especially important when it comes to nature damages. However how the municipalities handle surface water flooding events in cities depend on loss data on address level.

Institutional resources, for instance within planning and municipal engineering, are critical to the capacity to adjust to local climate challenges and the impacts of climate change (Næss et al., 2005; Tompkins & Adger, 2005). Lisø and Kvande (2007) emphasize the need for adaptive adjustments to climate change-related issues in municipal planning, supervision and development of policy instruments. However, as local knowledge on climate challenges and climate change is often informal and undocumented (Eriksen et al., 2009), it will be important to develop more thorough and accessible documentation here. Further, inadequate municipal development of statutory risk and vulnerability analyses is an obstacle to creating a society well prepared for worsening climate conditions (Aall et al., 2011; Almås, 2013; Flyen et al., 2014). Næss et al. (2011) have noted the importance of more comprehensive collaboration between research, industry and public sector at all levels. Flyen et al. (2018) conclude that the municipalities require assistance to achieve the level of knowledge necessary to prepare suitable climate adaptive measures and policy instruments, even if there is considerable (informal) local knowledge. *All these studies substantiate the impression of Norwegian municipalities' need for new, different and supportive information to supplement available knowledge and information.*

4.3 Further research

In Western countries there have been efforts aimed at using insurance loss data as a basis for developing models for dealing with surplus water flooding events and similar. However, there has been very little research on how to arrange for regular sharing of loss data. This requires co-operation between the insurance sector and public authorities, as well as review of the juridical aspects concerning the protection of privacy. There is also a need for social economy research on the cost-benefit of an arrangement like this. Social scientist of different disciplines should initiate interdisciplinary research on these matters to provide a basis for politics on the use of loss data. Klima 2050 intends to follow up with further work on insurance loss data for climate adaptation through case studies of selected municipalities.

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6 Appendix

Interview guide (translated from the Norwegian original)

The insurance companies' role in climate adaptation and prevention of nature hazards

- Are you familiar with the municipalities' needs for loss data, and the societal benefits of these data?
- To what degree do you see prevention/mitigation of the impacts of climate change as one of your company's areas of responsibility?
- How do the insurance companies contribute to the prevention of climate-related nature events (more than the interest group Finance Norway does)?
- Have you established co-operation with municipalities today? How? Would greater co-operation be possible, and if so, in what ways?
- Example 1: If a client suffers to three basement floods in a row, how would you react/what would you do?
- Example 2: If a municipality contacts you and asks for loss data related to a specific event, what would you answer?
- What are your experiences with the municipalities – do they take responsibility for prevention measures after (climate) damages?

Attitudes towards sharing of loss data

- What are the attitudes to sharing of loss data in your company?
- What is your impression of these attitudes in the insurance business?
- What would it entail for your company to share address-level loss data?
- Did the sharing of loss data in Finance Norway's pilot project have any consequences for those of you who participated? If so, what consequences?
- Do you see any positive economic consequences for your company as regards sharing address-level loss data? If so, what are they?
- How does sharing of loss data affect competition with other companies? What if all companies participated?
- Do you analyse your own loss data? In what ways?
- How important is it for your business that loss data on address level is kept intern in your company? Are there other aspects than loss data you can focus on, as regards competition in the market?
- Are there differences in the various insurance companies' portfolios and understandings of risk that will affect their attitudes on sharing of loss data?

What does it mean for the insurance companies to share loss data?

Data on address level require a system that can safeguard the commercial aspects, protection of privacy and client confidentiality. According to the Norwegian Data Protection Authority (DPA), Finance Norway was granted exemption from the law on personal information because DPA did not consider the loss data as being 'sensitive' in a legal sense; moreover, without access to loss data it would be difficult for the municipality to fulfil regulations and responsibilities. With the Directorate for Civil Protection (DSB) project for sharing of data (the knowledge bank), consideration will be given to the need for log-in/ restricted access for some data types.

- Do you still have doubts concerning the legal considerations? Which?
- Does it matter what organization administers the loss data? which organization should it be?
- What requirements do you have for sharing loss data on address level?
 - that it is a responsibility imposed on all insurance companies?
 - that it takes place only once, once a year, or monthly?
 - that the companies receive payment?
 - other points?

- What would you want in return for sharing loss data?
- On what level do you feel it is possible to share loss data?
 - Address level/ with GPS, or aggregated level– on what level? Or aggregated on year or month?
- Does it matter who gets access to the loss data? To what degree is commercial sensitivity important?
 - governmental agencies (DSB, NVE, Miljødirektoratet, Statens vegvesen etc
 - municipalities/ county municipalities/ county governors
 - consultants
 - researchers and students
 - the media
 - others?
- Is log-in important?

If municipalities are to use the loss data for risk and vulnerability analysis, or evaluations of nature events, it would be practical if the data could be shared with various departments in the municipality, and with contracted consultants and private stakeholders working in the municipality. In the pilot project, the municipalities were uncertain whether this was acceptable.

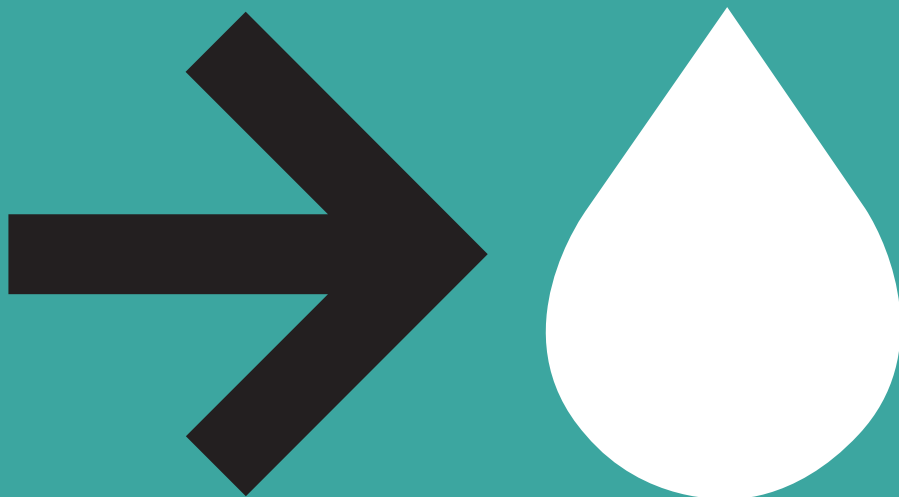
- What are your thoughts on giving municipalities this opportunity to share loss data with involved stakeholders?

Technical prerequisites for sharing the loss data

For the municipalities to utilize loss data, the following information has been specified as necessary: date, time, place (GPS/GIS) (address, building number, altitude above sea level), water level in the building, VASK code (water damage cause), amount of compensation (through an app or through automatic registration).

- What changes in process or technology in your company would be required to achieve sharing of loss data?
- How far has your company come in the process of digitalizing the registration of damage? How is it done? Do you have further plans for digitalization here?
- We understand that many insurance companies use In4mo as a tool for registration of damage: does your company? Are you open to the loss data being transferred directly to other administrators' (Finance Norway or DSB) solutions for making the data available to the right stakeholders?
- What technical changes for registration of loss data would be needed, in terms of costs for training, resources and investment in new digital solutions? Are these a type of investment your company intends to make in any case, or is willing to make for the benefit of society?

Thank you for all your help!



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