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"Someone will take care of it". Households' understanding of their responsibility to prepare for and cope with electricity and ICT infrastructure breakdowns

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ABSTRACT

Extensive infrastructure breakdowns are likely to become more frequent in the future as a result of continually complex and interconnected infrastructures vulnerable to weather and climate changes as well as intended attacks. By means of ethnographic interviews with households in Norway, this article examines their engagement in preparing for and coping with such breakdowns. It focusses on the division of responsibility between households, the authorities, and industry actors, and demonstrates that households do not believe they are responsible for preparedness, saw little advantage in contacting the authorities or industry actors, and chose to wait until someone handled the outage. However seemingly unprepared, households mobilised their social networks, used skills from previous experiences, local knowledge on infrastructure and weather, and material resources. Despite low engagement in the preparedness measures suggested by the authorities, we propose households to be considered key actors in societal preparedness by calling for greater attention to the socially shared practices households engage in that are not explicit preparedness actions, and for crisis management policies in the energy sector to provide the vehicles to mobilise household resources.

1. Introduction

When hurricane Dagmar hit the coast of Norway in December 2011, it caused massive tree falls over the power lines and 35,000 households lost their electricity supply for more than 24 h. Telecommunications were also down due to limited battery capacity and lack of power generators at the base stations, leaving over 30,000 subscribers without a landline and with unstable mobile coverage (Norwegian Communications Authority, 2012). In January 2014, an unexceptional house fire started in Lærdal in western Norway, but strong winds in the middle of a dry winter season led the fire to rapidly spread across the village. Base stations for electricity and telecommunication burnt down, causing a major outage that affected the municipality and surrounding areas (Norwegian Directorate for Civil Protection, 2014).

Both events were related to strong winter winds, and although they cannot be directly linked to climate change, researchers agree that we must expect more extreme weather events like these in the future (IPCC, 2012, 2018). The electric power grid is particularly vulnerable to storms and floods, and electricity is considered as the single most critical infrastructure to which all other depend (Ferranti et al., 2017; Karagiannis et al., 2017). Further, as the interconnectedness of infrastructure systems are becoming ever-more complex, breakdowns might cause cascading effects, meaning that interdependent systems such as electricity and Information and Communication Technologies (ICT) might produce non-linear consequences leading to the failure of other systems relying on this infrastructure (Graham, 2010; Matthewman and Byrd, 2014; Pescaroli and Alexander, 2018). Recently, Pescaroli et al. (2018, p. 162) have called for further research on household level preparedness for such cascading risks, emphasising the need for knowledge about the type of measures needed, as well as when and how they should be implemented. With the transition to a renewable energy system, which might imply a higher frequency of breakdowns, it is crucial to gain knowledge about the consequences for households. The article takes this call as its starting point and argue that valuable knowledge about household level preparedness to cope with infrastructure breakdowns can be gained by studying everyday practices.

Our everyday lives are dependent on electricity and ICT. We need

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infrastructure to buy and store food, cook, heat and light our homes, do laundry, to communicate and work, for transportation, use credit cards and so on. Although to a varying degree across populations, extensive outages affect the way people carry out these daily practices (Ghanem et al., 2016; Silvast, 2017; Trentmann, 2009). By means of in-depth interviews with rural households about their experience with hurricane Dagmar and the Lærdal fire, and with rural and urban households on preparedness for future outages, this article explores how households themselves understand their role in society's preparedness, and the resources they possess to cope with infrastructure breakdowns.

The article continues with a brief overview of the energy regime in Norway, before outlining the concept of preparedness in section 3. In section 4, social practice theory is suggested as an analytical tool to understand preparedness as embedded in everyday life. Section 5 presents the methodology and data material. In section 6, we present the results, while the final section discusses policy implications for future risk management policies.

1.1. Norway's energy regime

For households in Norway, we can broadly distinguish between two types of energy use; home and transport (Poortinga et al., 2004). Whereas transport is still mainly dependent on fossil fuels, domestic energy use is covered by electricity. Hydropower completely dominates the Norwegian electricity production, and the domestic production matches quite closely the domestic demand. However, there is a scheme for transition of electricity between the Nordic countries, by both physical interconnectors, and by financial market integration.[1] The electricity production in the various Nordic countries are not only geographically diverse, but they also use different modes to produce electricity: Hydro power, coal-fired power plants, wind power production, combined heat and power plants and nuclear power plants (Byman, 2016). This increases the security of electricity supply, as Norway also has the possibility to be a net importer in years when there is lower hydropower production, for instance in seasons where rain-, and snowfall do not match demand (White Paper no.25 (2015–2016)). Usually, a high share of renewables in the energy mix is considered to require storage capacity in the form of batteries. This is often stressed by scholars studying transitions to variable renewable energy (VRE) (e.g. Australian Energy Market Commission, 2018; Sepulveda et al., 2018). However, a hydropower-based system has an inherent capacity for storing energy through high-capacity reservoirs. This may even have the potential to store electricity produced by other energy sources, as options exists for using electricity to pump water back up into the reservoirs. Frequently referred to as a 'green battery', Norway is often suggested to serve as a backup for larger regions as the country holds approximately 50 per cent of Europe's reservoir storage capacity, with a total capacity of 87 TWh (Gullberg, 2013).[2] It should be noted that reservoir hydropower are constrained to specific favourable geographies, and that there is significant (local) environmental impacts of hydro reservoirs (Sepulveda et al., 2018).

The dominance of a variable renewable energy source makes Norway a special case, at least in the European context. This feature is interesting for at least two reasons. Firstly, as to learn how the system and actors have adopted to variable renewable energy. For other countries, there will be a transition period when phasing in variable renewable energy sources. To what extent such transition of variable renewable energy source makes the electricity system more vulnerable, is a matter of some contention. It is common to use the term security of supply, which covers both failures of supply due to a mismatch between supply and demand but even failures due to faults in the transmission and distribution systems. There has been concerns about the security of supply with the transition from 'traditional' electricity generation to variable renewable generation. This matter has been examined in several countries. Both Australian and German reports suggest that security-related supply interruptions have only accounted for a very small fraction of supply interruptions to households over the past ten years, while the share of renewable electricity production has increased (Australian Energy Market Commission, 2018; Clean Energy Wire, 2019). However, this at least partly depends on how the transition to renewable energy sources is done. Finally, technological diversity is considered beneficial for the supply quality and security of a renewable energy supply (Camargo and Stoeglehner, 2018). Further, there is internal complexity and significant levels of interdependence between ICT and energy systems. Internet and telecommunications, for example, require an external power supply (Petermann et al., 2014). At the same time, the power system itself depends on ICT, which constitutes central parts of the remote control, supervision and protection systems that assist in improving the resilience of the power system (Torres, 2013).

The security of supply and the stability of the Norwegian electricity production is good. One indicator for this is the energy not supplied relative to the energy supplied to end users. For 2018, this amounted to just 0.12‰ (per thousand) (excluding notified interruptions) (Flataker and Nielsen, 2019). This may contribute to the dominating perception in Norwegian households that the risk of interruptions is low, and as such adding to the low level of engagement in preparedness for outages.

2. Household preparedness

Lakoff (2007) defines preparedness as a modern risk management strategy, based on the ethos that society must be ready to deal with any potential catastrophic event when it occurs. Governing through preparedness thus means that whether society needs to prepare is not questioned, but rather what measures a society should design and implement to minimise the consequences of an event (Collier, 2008; Collier and Lakoff, 2008). As the occurrence and consequences of catastrophic events are impossible to control, preparedness entails that we must be in a 'continuous state of readiness'. How we imagine future events to be, shapes our readiness for them (Anderson, 2010).

Disaster studies have provided valuable knowledge about the social determinants of individual and household preparedness (e.g. Becker et al., 2012; Becker et al., 2017; Bourque et al., 2012; Bourque et al., 2013; Eiser et al., 2012; Murphy et al., 2009; Paton and McClure, 2013; Paton et al., 2006). These studies report that people do not prepare although they are aware of a risk. Preparedness is viewed as too time consuming compared to the perceived risk level. The motivation of households to prepare is thus dependent on factors that determine individual risk perception. These include the nature of the threat (whether it is close and visible, has long-lasting effects), previous experience with disasters, information and knowledge about the threat, and homeownership and family structure (Donahue et al., 2014; Hawkes et al., 2009; Helsloot and Ruitenberg, 2004; Wachinger et al., 2013). An important finding is that previous experience with a specific event have a high probability of leading to future preparedness for similar events (Becker et al., 2013; Wachinger et al., 2013).

A large body of research studies community resources during disasters. It has been long recognised, for example, that community-based emergent groups can be mobilised during disasters (Drabek and McEntire, 2003; Quarantelli, 1984; Stallings and Quarantelli, 1985). Moreover, improvisatory techniques where existing capabilities are used in new ways are found to be important resources (Kendra and Wachtendorf, 2003, 2007). Social resources within a community, including 'a sense of community' and a high level of social capital or networks, are all contributors to a higher level of preparedness (e.g. Cutter et al., 2008; Dynes, 2006; Johansson and Linnell, 2012; Kapucu, 2008; Kim and Kang, 2010; McEntire and Myers, 2004; Paton, 2007). Other forms of capital such as human, physical, and financial are also

[1] The Nordic market is also integrated, in both physical and financial terms, with power markets in the rest of Europe.

[2] https://energifaktanorge.no/en/.

found to be significant for community disaster response (Rademacher, 2013).

Nevertheless, there is reason to discuss how the concept of preparedness has been used in research and in policy to date. Together with similar concepts such as disaster risk reduction (DRR) and disaster risk management (DRM), as well as the more overarching concept of resilience (see Tierney, 2015), preparedness is clearly a current issue, highlighted in recent international policy documents such as the Hyogo framework for action (ISDR, 2007) and the UN's disaster resilience scorecard for cities (UNDRR, 2017). However, according to recent research on the conceptualisation of preparedness, there is a lack of consensus about what preparedness entails among scholars. Staupe-Delgado and Kruke (2018) argue that a strong applied focus within disaster studies has led to little theorising of concepts such as preparedness (see also Sutton and Tierney, 2006; Tierney, 2007, 2015). Kirschenbaum (2002) points to the political origin of preparedness, which he argues reflects the language used in preparedness studies. This view is supported by Baker (2013, 2014) and Baker and Grant Ludwig (2018) who claim that a 'traditional preparedness' view is dominant within the field. Traditional preparedness is conceptualised as planning activities, training, drills and exercises, preparedness kits and supplies, defined as an 'attribute-based' view by Kirschenbaum (2002). Baker (2013) further argues that traditional preparedness has a top-down approach to preparedness, where relevant preparedness activities are defined by the authorities or organisations. In an extensive review of the concept of preparedness, Nojang (2015) argues that preparedness is most often measured as a state of readiness – to complete an action in relation to preparedness – and when measured as such, the level of preparedness tends to be low.

According to Tuohy et al. (2014), disaster research on household preparedness has to date been conducted within a socio-psychological perspective, which is largely based on the correlation between individual perceptions and attitudes and preparedness behaviours. This implies that if individuals are correctly informed, aware of, and knowledgeable about preparedness, they will behave accordingly (Lupton, 2013). However, the individualised cognitive perspective rarely include the wider social context (Lindell and Perry, 2000). Also, most preparedness studies are based on quantitative surveys where respondents report on predefined responses to preparedness. However, it is unclear whether they are in fact the most relevant preparedness indicators (Diekman, Kearney, O'Neil and Mack, 2007; Uscher-Pines et al., 2012).

Our aim in this article, is to provide knowledge on why households seem to have a low engagement in preparedness. This we do by looking at the social context through the lens of social practices. We make two arguments: (i) that preparedness is low only when conceptualised as an active state of readiness, and (ii) that policies aimed at increasing awareness does not necessarily increase the level of preparedness. The article brings forth a social practice perspective that studies how household preparedness is interwoven in an array of everyday practices. Preparedness understood as part of social practices, we argue, is a built-in and taken for granted capacity to cope with outages within a given social and cultural context (Heidenstrøm, 2019; Heidenstrøm and Kvarnlöf, 2017; Heidenstrøm and Rhiger Hansen, 2020). Such an argument also has important implications for risk management policy. Rather than increasing awareness in the general population through information campaigns that promote active citizen participation in preparedness, we suggest that such policy should recognise that household preparedness includes a variety of practices that are seemingly unrelated to preparedness. We believe that a social practice perspective on preparedness for infrastructure breakdowns is beneficial to policy because it provides an understanding of why citizens are unengaged in preparedness, as well as to emphasise social, cultural and material resources of households that are currently understudied.

3. A social practice perspective on household preparedness for infrastructure breakdowns

A number of studies have used a social practice perspective to understand how households use energy and ICT (e.g. Gram-Hanssen et al., 2016; Hansen, 2018; Hargreaves et al., 2010; Pink and Mackley, 2012; Røpke et al., 2010; Shove and Walker, 2014; Strengers, 2012; Wilhite et al., 1996). Such studies argue that a different type of knowledge about energy consumption is produced by looking at socially shared practices, instead of individual behaviour (Labanca and Bertoldi, 2018; Shove, 2010; Southerton, 2013). Contrary to behaviourism, the social practice perspective recognises that most of what we do is not a result of reflexive decisions, but that we rather do and redo socially and culturally shared practices. Moreover, behaviourism downplays the importance of the social and political contexts that produce specific preparedness discourses (Blake et al., 2017). Our aim in this study is thus to move away from behaviourism, and rather look at how preparedness is intertwined in the socially situated everyday lives of Norwegian households.

Although practice theory is not one unified theory, a sensibility to practice has been present in the social sciences dating back to scholars such as Giddens (1984) and Bourdieu (1977). In this article, we make use of a practice perspective outlined by Schatzki (1996), suggesting that the social world is entirely made up of practices. Practices can be studied as entities consisting of elements that together form a practice. Shove, Pantzar, and Watson (2012) propose these elements to be grouped as *competences* (all forms of explicit and embodied knowledge and skills), *meanings* (the social significance of participating in a practice, the norms, values and emotions associated with a practice), and *materials* (things, technologies, infrastructures and physical surroundings). When studying the performance of practices, we look at how these elements come into play when a practitioner does a task such as light a fire or cook a meal, and how practices are interconnected. Some practices can be studied as units. However, we argue that preparedness is not something that is done in itself. Preparedness is the result of households' performance of several practices, and can be defined as the ability to sustain infrastructure dependent practices without access to infrastructure (Trentmann, 2009). During outages, infrastructure-dependent practices lose one of their material elements and need to be reconfigured to persist. To do so requires alternative materials and associated competences. From a practice perspective, these resources do not belong to the individual but to the practices individuals perform.

Over the past few years, some studies have engaged with how infrastructure breakdowns affect household practices. A case in point, which shows the interdependence of ICT and energy systems, is the loss of power in Lancaster due to flooding (Kemp, 2016). The subsequent blackout affected a number of other services that the public take for granted, and that greatly affects their everyday practices: mobile phone coverage was lost within an hour, internet was lost, electronic payment systems and ATMs did not work, digital radio services (DAB) were affected, no fuel for vehicles as fuel pumps were driven by electricity, Lancaster university cancelled lectures and exams and ended the term early (Ferranti et al., 2017).

Ghanem et al. (2016) looked at how British households coped with such outages, and found strategies of tweaking household practices for cooking, heating and communicating to maintain an acceptable level of comfort. Moreover, the local community distributed their available resources amongst each other. Wethal (2020) and Heidenstrøm and Kvarnlöf (2017) similarly found that rural Norwegian households were able to mobilise coping strategies during blackouts, and that these strategies were already part of their household practices. Both studies emphasise that infrastructure breakdowns were considered low risk, and could even be framed as cosy (see also Guldåker, 2009; Helsloot and Beerens, 2009; Silvast, 2017). Wethal (2020) further argues that living in a rural location invoked an identity of being able to cope without help

from the authorities. Heidenstrøm and Rhiger Hansen (2020) find that rural households had a higher level of competence to cope with infrastructure breakdowns than urban households did due to their previous experience, local knowledge and extensive social networks. Helsloot and Beerens (2009) report that Dutch citizens considered outages low risk and were able to continue their everyday lives during the outage, mobilising existing resources.

Taken together, these studies demonstrate that household preparedness is influenced by other factors than those directly linked to preparedness for outages (Ghanem et al., 2016). These factors include local knowledge of weather, climate, place and people, the flow of social and material resources in various kinds of social networks, the division of labour between men and women in the household, energy consumption habits, mobile phone use and so on. In the present article, we aim to show the differences between understanding preparedness as readiness, and understanding preparedness as embedded in social practices. The following section presents our case in more detail.

4. Methods and data material

There is a need to extend the research methodologies used to study the constituents of household preparedness (Tuohy et al., 2014). The ethnographic interview approach of this study, aimed to produce in-depth data about how households themselves understand preparedness within the context of everyday life, gives primacy to social and cultural knowledge. Our position prior to entering the field was that most households did not actively engage in preparedness. This was confirmed by a representative survey (N = 1005) that we conducted in 2016, a year into the qualitative data collection. The survey results show that about 15 per cent of Norwegian respondents had an emergency plan and knew of local meeting places, only seven per cent knew of local preparedness plans, while 30 per cent knew where they could get information from the authorities during a disaster (Storm-Mathisen and Lavik, 2016).

Our research interest has thus been to explore preparedness through the social, cultural, and material resources that could be mobilised during infrastructure breakdowns. To identify these resources, we constructed a methodological design that emphasised the performance of social practices. First, we used a 'performance-based interview style' (Hitchings, 2012), focussing on how infrastructure-dependent practices (e.g. cooking, heating, cleaning, lighting) could be performed without access to infrastructure, and on future scenarios ('what would you do if the infrastructure broke down right now?'). Other key themes in the interviews were previous experiences with limited access to infrastructure, use of material resources that are part of household practices, communication and social networks, and knowledge about governmental and industry preparedness plans and actors. Second, we conducted 'walk-along tours' (Carpiano, 2009; Kusenbach, 2003; Pink, 2007) in the homes of the participants, focussing on use of material resources and demonstrating different practices without infrastructure. Third, these tours were photographed, producing inventories of resources as well as usage during the tour. For a detailed account of the methodology, see Heidenstrøm (2019).

The design was implemented in at-home visits to 25 Norwegian households, organised in two case studies.[3] Case Study I consists of visits to households in Lærdal who experienced hurricane Dagmar as well as the fire. A municipality employee came to be a key informant that contributed to recruiting nine households and six governmental actors (the latter not included in the present analysis). The main recruitment criterion was households who lost their electricity and ICT supply during and in the aftermath of the events. Secondly, we aimed to cover different age groups (16–25, 25–40, 40–55, 55–70, 70–85 yrs), we pursued even gender distribution, as well as differences in family structures (couples and single households with and without children). Case Study II examined how rural and urban households prepared for future infrastructure breakdowns. We recruited six households in the rural municipality Grue and ten households in Norway's capital Oslo, by means of Norstat recruitment agency, using the same recruitment criteria as above. All interviews were conducted between 2015 and 2017 and were fully recorded and transcribed. The total sample includes 42 participants (22 women and 20 men), with an average age of 47 (17–84 years), as well as different dwelling and household types. Tables 1-3 in appendix 1 provide a detailed overview of the data material.

The data analysis was conducted using the classic inductive strategy suggested by Glaser and Strauss (1967). A first step included an inductive reading where we identified words and phrases used by the participants. These were in a second step organised into codes that represented similar words, phrases, and narratives. The codes were added to the HyperResearch software, and all interviews were coded. In a third step, codes were connected. Importantly, the case study analysis is an 'embedded analysis' of one specific aspect of the case, the infrastructure breakdown (Creswell, 2007; Flyvbjerg, 2006).

Although hard to define, saturation of the sample was considered using two strategies. First, towards the end of the interview, all participants were asked whether they had anything else to add to the topic of interest to ensure that we had covered as many aspects of the topic as possible. Second, analytical saturation was reached when no new narratives about the topics of interests were found in the material, and no new codes were generated (Guest et al., 2006). Trustworthiness of the data was ensured through methodological triangulation within the qualitative design using the three techniques described above to gather data, as well as by participation of multiple researchers in the data collection, including discussions after each interview, and analysis including generating codes, reading transcripts, and producing analytical categories (Denzin, 2012; Golafshani, 2003).

Methodological limitations to be considered include the post-event research design, meaning that we did not observe the actual performances of the participants during infrastructure breakdowns. Moreover, the sample in Case Study I consists of families with similar socio-economic status, dwelling type, and family structure, and is more homogenous than the sample in Case Study II, where greater variation was achieved. Different recruitment strategies might also have influenced the selection of participants. The study was conducted within the cultural, social and political context of Norway. Research from other developed countries have yielded similar results as those presented here (see section 4), but research on infrastructure breakdowns in developing countries where the infrastructure system is less stable and where the political system is different, other coping strategies are found to be of importance (Ghanem, 2018; Graham, 2010).

5. Results

The results section explores the level of engagement in preparedness among the participating households. We do this firstly by looking at acquisition of material preparedness resources, the immediate response strategies of households, and how households understand the division of responsibility for preparedness between themselves and other actors. Secondly, we argue that the lack of engagement in preparedness is not the same as being unprepared. We identify coping strategies that are found to be important during infrastructure breakdowns, because they fall outside the conceptualisation of preparedness as an active state of readiness. These, we have labelled informal preparedness measures.

5.1. Engagement in preparedness

In line with Baker (2013) who found little or no engagement in explicit preparedness practices among her interviewees, and Helsloot

[3] The Norwegian Centre for Research Data (NSD) has approved the project, and all participants signed a written consent right after the visit containing a separate section for consenting to the use of photos in dissemination activities.

and Beerens (2009) who report that over half of respondents did not know in advance what to do during a power outage, the participating households in our study had not thought much about preparedness or implemented any measures they themselves defined as preparedness. None of them had drafted a family emergency plan or were stocking supplies for the purpose of preparedness. For most of them, it was not something they had engaged in at all, which was commonly expressed, in particular in the urban households: '*No, we don't think about that on an everyday basis*' (Man, 51, Oslo), *'I don't really think much about preparing for blackouts, I don't really'* (Woman, 29, Oslo), *'We obviously don't give a damn about preparedness, but it is smart to think about it'* (Woman, 50, Oslo), *'We take electricity for* granted *in 2017, right. Especially when you have grown up with it and have never experienced not having it'* (Woman, 31, Oslo).

The lack of explicit preparedness actions is also evident from the type of material resources present in households. In the interviews, the families were presented with a list of supplies provided by the Norwegian Directorate for Civil Protection (DSB) to advise households about preparedness.[4] We asked whether the families had heard about the list or owned and maintained supplies. Further, we asked them to show us the resources they had at home. None had heard about the list, but many already owned several resources such as batteries, candles, flashlights, battery radios, gas burners, and canned food, and in the rural households also firewood. However, these were not given meaning as preparedness resources.

What is particularly interesting here are the resources that were not present in the households. For example, only one family had stored bottled water to cover three days demand. Bottled water was not used in any existing household practices. Thus, this was a resource to be acquired and maintained specifically for preparedness. Outages may have a knock-on effect on water provision, as this is dependent on both ICT-based systems to function properly, and electricity for water pumps. One of the participants talked about storing water:

> *No, I have not stored any water, I just take it from the tap, so … I guess I don't have that. (…) The first thing I would do would have to empty a soda bottle and filled it with water instead. I would have to fill water in bottles I already have, eh …* (Woman, 29, Oslo).

Permanent storage of water was believed to be unnecessary because the families relied on getting information about upcoming infrastructure breakdowns or anticipating it themselves. Such knowledge gave the participants enough time to fill up bottles, buckets or their bathtub, as this participant said: *'Like at Christmas we got a weather forecast about heavy winds. Then we wanted to be precautionary and stored water'* (Man, 40, Grue). Some considered it unnecessary in any situation, as this participant argues: *'No, we have not stored water. You drink like 2 L each, so we had to have enormous amounts of water for it to be of any help'* (Man, 45, Oslo). Others believed they would get access to drinking water in wells, creeks, or use the water in their boiler, particularly in the rural households:

> *Here we have rivers and creeks in the mountains from which you can get drinking water. So, having drinking water for three days, you are supposed to keep it cool even. Then you would have to have a tank. No, this is city preparedness. Even though the directorate should cover the whole nation, they have not gotten further than thinking about cities. It should have said 'only for cities' on that list* (Man, 72, Lærdal).

The above quote also shows differences between rural and urban households. While rural households argued they could cope with their existing resources, urban households expected other actors to fix the problem rapidly. This is further discussed below.

A second resource considered unnecessary was to write down important phone numbers in case mobile phones were to run out of battery. Most participants did not have such a list and some even reacted with surprise, like this family:

> Interviewer: *You have a landline, so do you have an address book or a list of phone numbers, or is everything stored in your mobile phones?*
> Woman: *Oh, no, we have … no!*
> Man: *(laughs)*.
> Woman: *I think that's crazy* (Woman, 68, Man, 70, Grue).

Unlike stored water that has never belonged to any household practice in Norway, address books were common to have prior to storing phone numbers digitally. With the technological convergence of the mobile phones, address books no longer serve any purpose beyond preparedness. The participants relied on functioning internet connection either by 4G or Wi-Fi during infrastructure breakdowns to get information and access to phone numbers, as talked about in this interview:

> Interviewer: *You do not have a landline, and if the electricity was to disappear, you would call the energy company. Is that a phone number you remember, or how would you do that?*
> Participant: *No, I would have to search the internet.*
> Interviewer: *But you would not have Wi-Fi?*
> Participant: *No, that's true. I would have to use 3G or 4G* (Man, 40, Oslo).

Such a line of argument was quite common in the interviews. Severe and long-lasting infrastructure breakdowns were not seen as particularly dangerous, and the participants believed that some infrastructure would be available within a short amount of time (Baker, 2014; Wethal, 2020). Thus, they presented alternative infrastructure dependent strategies that they believed would work, which is also found in other studies of disrupted ICT infrastructure (Al-Akkad et al., 2013). Their dependency on and trust in a functioning infrastructure is also reflected in not having cash available, which is another preparedness resource listed by the authorities. Some had cash at the time of our visit, but it was by chance, like this participant said: *'(laughs) it was just pure luck that we had cash back then [after the Lærdal fire], I would not had that today, I just happened to have it at the time'* (Woman, 55, Lærdal).

Low implementation of recommended preparedness measures might be seen as a consequence of the social and political context of the Nordic welfare regime. According to Cornia et al. (2014), the Nordic countries belong to a 'state-oriented risk culture' where citizens expect the government to take responsibility in case of crises. According to Aune et al., 2011, the energy culture in Norway is similarly state-oriented. Norwegians expect a stable electricity supply across seasons, at a low cost. Several studies have also shown that citizens who believe that being prepared is in part their own responsibility have a higher level of individual preparedness compared to those who believed that the responsibility lied with other actors, such as the authorities (Basolo et al., 2008; Lindell and Perry, 2000; Paton et al., 2006; Terpstra and Lindell, 2013).

5.2. Waiting as a response strategy

Although Norway has experienced several extreme weather events over the past ten years, the participants did not consider them to be dangerous or frequent enough to actively engage in preparedness. In a Swedish context, Palm (2009) similarly found that households did not consider themselves responsible for preparing for outages, and during an outage they expected the grid company to fix the problem and

[4] In 2015–2017, the list included bottled water, dried foods, a battery-operated radio, flashlights, candles, matches, firewood, a first aid kit, and a primus. The list was updated in 2018, and now include more detailed recommendations regarding of water and food, medicines and other health related supplies, cash, fuel and iodine tablets. The full list can be viewed here: https://www.sikkerhverdag.no/en/being-prepared/incidents-and-crises/advice-on-self-preparedness-for-emergencies/.

municipalities to take care of citizens (see also Palm, 2008). Only about a third of the respondents contacted the grid company to obtain information about the duration of the outage. This lack of engagement was a result of how households understood a division of responsibilities and seeing themselves as capable to handle an outage with existing resources.

One of the participants summed up the overall attitude we found in our study: *I don't think I would be very worried nowadays either* (laughs), *I just think that I would trust it to be fixed, and just waited it out'* (Woman, 37, Oslo). Many also expressed that they did not want to be of nuisance to the responsible actors during an outage:

> Woman: *I don't feel that we were very active in finding out when the electricity would return either.*
> Man: *No, but we had what we needed.*
> Woman: *Yes, and we might not be the first ones to call and nag.*
> Man: *We do not worry, and we do not nag* (Woman 39, Man, 40, Grue).

However, urban households expected the outage to be fixed within a shorter amount of time than the rural households did. One of the participants from Grue talks about this:

> *The nearby village got the electricity back a lot sooner than us out here. They prioritize areas that are populated, you know. As I said, we are at the end of the power line, I think, and there are always problems with the generator up here* (Man, 69, Grue).

In rural areas, households believed that they should and was expected to manage for an extensive period without infrastructure, as one participant talked about: *'Are there any limitations? We would have dirty clothes eventually, but we would manage. We have what we need (…). We could manage for a long time'* (Man, 40, Grue).

Rural households also appeared to be more active in contacting authorities and companies during an outage. This participant compares his activities living in an area with few people to his present residence in a more populated area:

> Interviewer: *Would you call the electricity company or something like that during an extensive blackout?*
> Participant: *I have not done that, because someone would alert them immediately*.
> Interviewer: *You think that it will be taken care of?*
> Participant: *Yes (…) but back when I lived in a different village I had to call immediately, there were so few people there, where I come from, so then I had to call. Here, there are loads of people that would call, you know* (Man, 69, Grue).

Statements like this where 'someone' was supposed to manage the infrastructure breakdown are explored further in the following section.

5.3. 'Someone' will manage infrastructure breakdowns

The word 'preparedness' was understood by the participants as part of a policy vocabulary that they did not relate to. When the participants talked about preparedness it was most often about governmental preparedness. The actors in these stories were not themselves, but rather national and local authorities, emergency personnel (police, ambulance, and fire dep.), and industry actors such as the grid operators or telecom companies. Most often, the responsibility for infrastructure breakdowns was given to 'someone' that at some point would provide alternative services or correct the problem, as this participant expressed; *'The most important reason is that I have thought that, I trust that someone has already discovered the error. That an alarm goes off somewhere, something happens'*

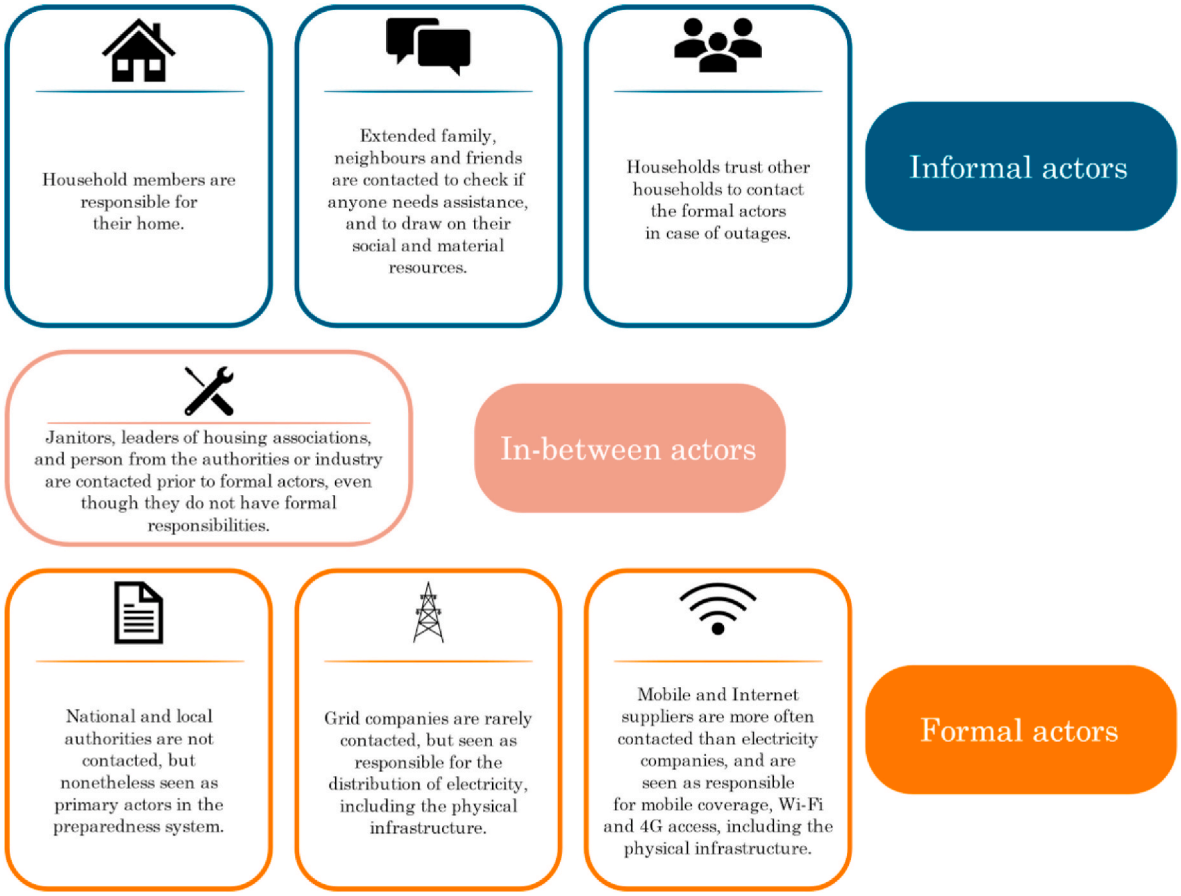

Fig. 1. Households' perceived distribution of responsibility for infrastructure breakdowns.

(Man, 45, Oslo). 'Someone' appeared to entail a range of actors, their responsibilities as well as how the households themselves related to them (Throne-Holst, 2012). In Fig. 1, we have categorized our empirical data in three interconnected categories of these actors.

Informal actors are defined as individuals within the household, from their own social networks, and other citizens in general. They are informal because they do not have any assigned responsibilities to manage outages. In case of an extensive outage, the households saw t hemselves as responsible for their own home for a certain amount of time, and would provide or seek help from neighbours, family and friends, as stated by one participant: *'Maybe I would have called someone that lives around here. I could have contacted my neighbour to check whether they had lost their electricity supply as well. Then I would check the online newspapers'* (Woman, 31, Oslo). The responsibility of households during extensive outages was seen to be limited to their own home as a material unit, and not the infrastructure beyond this. The services coming into their homes such as energy and water supply, internet and mobile coverage were seen to be the responsibility of authorities and grid companies.

In-between actors are defined as individuals the participants knew in person and could contact directly. For example, one participant talked about their housing association: *'I don't think I would have contacted anyone (…) the chairman [of the housing association] would have taken the responsibility*' (Woman, 50, Oslo). In-between actors could also be people in the participants' extended social networks that worked as engineers, in the military, the fire department, or that had contact with the authorities. These individuals might be contacted for aid or information during breakdowns.

Some members of the rural households we interviewed saw themselves as such in-between actors. One participant said that: *'A friend called me [during the Lærdal fire] because he knew that I was a former fire fighter, and that he would get information from me* (Man, 69, Lærdal). Some participants also wanted to take an active part in ensuring that the infrastructure was functioning, but were not always allowed to, like this farmer talks about:

> *A friend and I offered to clean up after hurricane Dagmar, in a forest area right up here. (…) several trees were leaning over the power lines, but it is the company's responsibility. My friend called them and said that the trees were in danger of falling over the lines at any time and asked whether they could send someone to cut them down. We did not want to do it ourselves, because if anything should happen, we are responsible. If the company could just send someone to cut down the trees, then we could remove them. But no, we were not allowed to* (Man, 45, Lærdal).

Stories like this also included events where the participants had broken regulations and tried to secure the power lines anyway. This can be seen as a 'moral economy' of preparedness. The farmers who wanted to cut down the trees had the equipment and the skills to do so and do the community good, but it would cost them money if anything went wrong because they have no formalised responsibility for preparedness. The farmer continued to say that: *"I have talked to the municipality about making a preparedness plan where all the knowledge and equipment that farmers like me have. Not just equipment, but our skills on how to use it. It is possible to call farmers and make a list"* (Man, 45, Lærdal). Measures to activate citizens in preparedness is discussed further in the conclusion.

Formal actors are defined as national and local authorities, grid operators and tele companies that were perceived to be the active part in risk management. These actors have legal responsibilities to ensure a secure infrastructure, and when the participants referred to 'someone' it was most often the formal actors, even though they were unsure about the distribution of responsibility between these actors. The participants took on different roles when talking about electricity supply and ICT services. For electricity, they took on the role as citizens, expecting energy supply to be provided by the authorities and companies. Very few had ever called the grid company and would not do so in case of an outage. For ICT, they took on the role as consumers, purchasing Wi-Fi and mobile subscriptions. Many contacted the companies and expected them to restore the infrastructure quickly (Throne-Holst et al., 2015). We consider this a result of the Norwegian energy culture where electricity has long been regarded as a common good for the whole population provided by the authorities, while ICT's are new technologies accessed in a market (Aune, 2007; Aune et al., 2011). Moreover, mobile services provide infrastructure to practices that are much more conspicuous than electricity (Shove and Warde, 2002).

5.4. Preparedness as part of everyday practices

The results section so far has explored why Norwegian households are unengaged in preparedness. However, there is a discrepancy between preparedness conceptualised as readiness, and the actual coping strategies of households. This discrepancy can be exemplified with a discussion with a couple from Lærdal:

> Interviewer: *Is there anything you do differently now after the fire, based on your experience?*
> Male participant: *No, we as private citizens do nothing. Your question should be asked to someone dealing with the preparedness plans.*
> Interviewer: *Yes, and we have done so. I was wondering, did you pick up lessons from your experiences?*
> Female participant: *I never light a candle outside if it is windy*.
> Male participant: *Oh, these are the things you ask about* (Woman, 66, Man, 69, Lærdal).

The couple continued to talk about precautions with using the wood stove during strong winds, where they kept their headlights and batteries in case of outages, and knowing how to regain mobile coverage from a near-by village (Heidenstrøm and Storm-Mathisen, 2017). These are materials and competences that are seldom given emphasis in preparedness studies. Nevertheless, they are part of the important resources of households in case of extensive infrastructure breakdowns.

The quote also points to a methodological discussion. When preparedness is conceptualised to consist of specific attributes, we are missing out on important knowledge about the tacit resources that might be important to the level of preparedness although it is not connected explicitly to preparedness (Kirschenbaum, 2002). In previous articles, we have given detailed accounts of these resources. Heidenstrøm and Kvarnlöf (2017) identified practices from hiking trips and cabin life, which consisted of important competences, such as lighting a fire and cooking with a primus, and owning and maintaining material resources, that would be crucial to manage without infrastructure. Heidenstrøm and Rhiger Hansen (2020) have further considered the importance of 'embodied competences' for household preparedness, defined as the skills of knowing how to perform a practice (Schatzki, 1996). An embodied preparedness competence consisting of three constituents was found to be of importance to preparedness: Firstly, previous experience was found to build competences to manage future outages. Whereas existing research has emphasised the impact of previous experience from disastrous events (see section 2), we found that experiences of living with limited access to electricity and ICT, for instance cabin life practices and older generations practices in a time where infrastructures were less developed, built a competence to dealing with outages. Experiences with long-term outages represented a 'moment of reflexivity' where the participants became aware of their own preparedness resources that could be mobilised and barriers to be addressed (see also Rinkinen, 2013). Secondly, knowledge about the local climate and weather conditions, the built environment such as base stations, power lines and tunnels and roads enabled households to anticipate outages and implement measures. Thirdly, extensive social networks involved a flow of resources in the form of information and skills, and material preparedness resources that were shared between members of the network. The embodied competence was found to be higher in rural than

Fig. 2. Participants displaying material preparedness (photos taken by the authors).

in urban households.

In Fig. 2, we have summarised some materials and competences, and the interconnectedness between them, found to be of importance to cope with and prepare for infrastructure breakdowns.

In the two top left photographs, a participant showed us how to use camping gear that he believed would be an important resource during outages. In the top right photographs, another participant gave us a tour of her kitchen where we talked about the family's shopping and storage routines. During these tours, we were given insight into the moral economy of the household practices. There was a division of responsibility between women who were more often responsible for food acquisition, storage and cooking, and men who were more often responsible for supplies of fire wood, tools, and car maintenance and fuelling. Consequently, different household members were responsible for acquisition and maintenance of different preparedness resources. We also found that dwelling size and storage space affected the amount of supplies. Detached dwellings had a lager stock of food, wood and fuel, as well as smaller items such as candles and batteries.

In the middle row, a scenario walk-along took place, and the participant showed us where the family kept their flashlight, and that he had a small amount of cash to be used in case bank terminals were not working.[5] The third photograph in this row shows tools that can be used in case of treefalls over the power lines.

In the bottom row, a woman showed us how to use their secondary heating source, a wood stove, which is present in over 60 per cent of Norwegian households (Statistics Norway, 2014). In the next photograph, a participant showed us his wood storage that he believed would last for several years. Another participant showed us their landline phone, which is present in only 15 per cent of Norwegian households (Norwegian Communications Authority, 2019). As the share of landlines are declining due to use of mobile phones, this is a preparedness resource that might disappear as a consequence of changed communication practices. However, resources such as the power bank for extra battery capacity on mobile phones shown in the next photograph, has over the past few years been integrated in our communication practices as a result of our dependence on these technologies even outside the

[5] In Norway, payment by credit card or mobile payment soultions surpass cash payments. 80% of all purchases were done using cards or mobile soultions in 2018, according to the National Bank.

home. The changes in this practice may also result in a higher level of preparedness.

These findings make the point that preparedness for infrastructure breakdowns exists embedded in many everyday practices, and when these practices are performed, important preparedness resources are established and maintained. Contrary to the active state of readiness that is argued to be the logic of preparedness (Lakoff, 2005, 2007), we frame these resources as 'informal household preparedness' (Heidenstrøm, 2019; Heidenstrøm and Kvarnlöf, 2017; Heidenstrøm and Rhiger Hansen, 2020). We use the term informal to emphasise that these resources are tacit forms of knowledge interconnected with material resources that can be mobilised during infrastructure breakdowns. Preparedness was found to be less related to individual attributes and individual beliefs, and more to the materials, competences, and meanings of their everyday practices. As others, such as Ghanem et al. (2016), Wethal (2020), and Silvast (2017) have shown in different cultural contexts, the ability to adapt the elements used to perform a practice, to provide heat or light for example, is imperative to the level of preparedness. Thus, preparedness exists in households even when preparedness is not the intent of participating in these practices.

6. Conclusions and policy implications

This article has shown some of the dynamics of preparedness for extensive infrastructure breakdowns at a household level and why it matters to overall societal resilience. We have pointed to an important difference between a low level of engagement in preparedness defined as readiness, and preparedness as embedded in everyday household practices.

Norwegian households typically framed preparedness as part of the policy discourse, assigning public authorities, policy makers and industry actors' responsibility for dealing with overall preparedness. When the electricity disappeared, the most common strategy was to wait until it returned or until they received more information. This was a result of the households' expectations to other informal, in-between and formal actors to take responsibility. This expectation is at least partly based on the high level of trust in public authorities among Norwegian households. However, households' informal preparedness resources contributed to upholding their everyday practices such as cooking and food storage, heating, lighting, communicating and so on, without infrastructure.

We argue that low engagement in preparedness does not mean being unprepared. The study contributes insights on the type of resources used by households during extensive infrastructure breakdowns. By applying a social practice perspective, the resources are framed as socially shared through the performance of everyday practices. This viewpoint can be useful for policy makers in defining the community preparedness within a specific political and social context. It is particularly useful when dealing with the potential cascading effects of infrastructure breakdowns. Developed societies grow ever more dependent on infrastructures that are increasing both in complexity and connectedness with other parts of the infrastructure, like those between the ICT and electricity systems. Such issues may increase the likelihood of failures, as it becomes harder to have a complete overview of the total system. This further implies it will take more time to identify and fix potential failures. The social practice perspective emphasises the extent to which everyday life is disrupted and needs to be re-established during such breakdowns, as well as the extent to which households can re-establish practices without access to infrastructure.

A further implication of this study regards the authorities' risk communication to citizens. The study suggests that households do not see themselves as engaging in preparedness. They will probably not engage in increasing their own awareness about preparedness or actively search for information. At home, they do not see it as necessary to perform preparedness measures such as to stock certain supplies. Consequently, information campaigns about preparedness at a national level might not yield the desired results (Tulloch and Lupton, 2003; Tuohy et al., 2014). Future risk communication would probably benefit from avoiding policy language, as well as develop communication measures that go beyond mere written information.

The important role of communities has been recognised in recent risk management policies. However, scholars such as Benadusi (2014) argue that such policies tend to include a normative vision of culture, and reproduce a dichotomy between expert and experiential knowledge. We propose that local authorities develop community-based strategies that take their starting point in the infrastructure-dependent practices households engage in, and the competences and materials within these practices. Participatory processes designed to develop community preparedness plans that include the tacit competences of households entail active participation and empowerment of households. Households have expertise on their own everyday life that can be crucial input for planners. By actively engaging with community members and stakeholders in the planning process, the planners both get vital input to their work while at the same time have an increased potential to achieve some degree of consensus among affected stakeholders and interests (Burby, 2003; Fiorino, 1990; Stirling, 2008). Including the local households in the development of preparedness plan would probably increase the likelihood that these plans will be read by household members (Scolobig et al., 2015).

One concrete suggestion to actively engage with citizens, would be to develop 'citizen state contracts'. Although we do not argue that responsibility should be shifted from authorities to community members, such contracts might enable authorities to take advantage of community resources. A contract could consist of a certification scheme given by the electricity company. The farmer who wanted and had the skills and equipment to cut down the trees to secure the power line, might be able to do so, or to assist in clearing vegetation around the power lines, under the supervision of the electricity company. We are, however, aware that this points to a certain dilemma: At the one hand we suggest that households represent resources in the event of infrastructure breakdowns, however, we would hesitate to advice that any formal responsibility should be assigned to households. Alternatively, as the farmer suggests himself, local authorities might benefit from creating an overview of material resources and knowledge within the community.

This article has presented how Norwegian households respond to infrastructure breakdowns. Although we see similar responses in other European countries (Ghanem et al., 2016; Palm, 2009; Silvast, 2017), more research is needed to understand how different energy regimes (e.g. a more competitive market or a lower level of trust in the authorities), lower living standards, other climatic conditions, and other social and cultural conditions might affect preparedness.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Nina Heidenstrøm: Conceptualization, Methodology, Investigation, Data curation, Writing - original draft, Writing - review & editing, Visualization, Funding acquisition. **Harald Throne-Holst:** Conceptualization, Methodology, Investigation, Writing - original draft, Writing - review & editing, Funding acquisition.

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