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Sense-making for anticipatory adaptation to heavy snowstorms in urban areas

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ABSTRACT

This paper takes a case of Xavier snowstorm of March 15–16, 2013 in two Belarusian cities of Minsk and Mahilioŭ, and uses it to demonstrate how failures in communication in organisation hamper adaptation to an extreme weather event even in such a snow-proof society as Belarus. Highly hierarchical governance by the state causes a number of institutional misfits and interplays resulting in major implementation and decision making deficits; for the same reason governmental organisations have limited capacity to learn and prepare for future adaptations. Non-state actors were reluctant to take pro-active approach on the phase of post-disaster sense-making, although they demonstrated strong leadership and selforganisation during the storm. Except generic governance issues in Belarus, this also can be due to mal-resilient institutional legacies lasting from USSR times.

1. Introduction

Cyclone Xavier, of March 15–16, 2013, will be memorable in Belarus for its impact on the country's infrastructure. Although Belarus and its cities are generally well prepared for snowfall, failures of communication during this powerful snowstorm shut down traffic within two of the country's most important cities, Minsk and Mahilioŭ. The forecast for the storm was issued on time and it was correct, however, the broader public and other parties concerned did not take this communication as a signal to change their usual routines and prepare. As a result, hundreds of thousands of people could not get back home for hours and often had to walk, not properly dressed, kilometres through a snowstorm. Thousands of car and bus drivers suddenly found themselves (and their vehicles) stuck in snow piles 1–2.5 m high. Those driving through open spaces on the outskirts of the city and peri-urban areas often could not even abandon their cars. Depending on their luck, patience and survival skills, many of them spent several hours or the whole night on crowded roads, side by side with other stuck vehicles.

Although the national economy and local communities did not suffer any major losses, and adverse events with greater salience regularly occur in Belarus (e.g., catastrophic floods in the southern part of the country) (Areshka, 2013), this was the first time that major cities, including the capital district, were affected. As a result, every single move of the state emergency response services was recorded, discussed and judged in the media and social networks, while the snowstorm, post-disaster recovery and follow-up remained a headline issue in the national media until the end of 2013. Judgements varied from

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relatively kind remarks that the state emergency response services could do much better, to harsher criticisms that they were almost paralysed. Positive assessments came only from government officials and from spokespersons of the services.

In Belarus, with its highly hierarchical governance, the national government is self-marketed and generally seen as able to guarantee security and stability with no help needed from non-governmental agencies. In this situation, the capacity of the government to provide security was seriously questioned by the public, while informal networks and self-organisation were recognised as extremely successful. This is an idea usually promoted by the international literature on local adaptation and resilience (Olsson et al., 2004; Folke et al., 2005), but highly atypical for Belarusian society. In response to this, government representatives, including the president, promised to take seriously the lessons of Xavier, and indeed, by the end of 2013, all the governmental bodies and agencies concerned issued press releases about meetings, extra drills and many other preparations being made to address heavy snowfall and snowstorms.

We are examining this case for the following reasons: (1) it clearly demonstrates the weaknesses and strengths of a top-down governance system (although a well-functioning one) in the face of an extreme weather event, and (2) it portrays vulnerability and adaptation issues that remain relatively unexamined, such as post-disaster sense-making for future adaptations (Linnenluecke et al., 2012) and the cultural and political factors of anticipatory adaptation in general (Adger et al., 2012; Granderson, 2014).

Aiming to explore the limits to anticipatory adaptation under the governance model existing in Belarus, this paper explores how disaster response governmental agencies and the broader society in Belarus took the lessons from Xavier, and whether the adaptive capacity of the affected communities was actually strengthened as a result. Our paper is guided by the following questions:

- What was the weakest component of the governance system that caused the failure of government agencies during the snowstorm?
- What was the actual learning impact of Xavier and how well was the sense-making process organised and supported?
- Given the reportedly good performance of non-state actors during the snowstorm, how does it compare with governmental agencies during the recovery and post-disaster sense-making stages (with implications for the anticipatory adaptations and adaptive capacity)?

To address these questions, we begin with a brief introduction into the research context, and offer an overview of the concepts and approaches used to understand and analyse adaptive capacity and governance for resilience and adaptation. Building on this context, we explain the methodology developed for this study, and describe the data and methods used for data collection. In the next section we analyse the governance infrastructure that is in place, the emergency response by the government and non-state actors and the flaws and successes of post-disaster sense-making. These findings are used to discuss key determinants of adaptive capacity, and to articulate the need for better interfaces between governmental agencies and open society organisations. The last section provides conclusions.

2. Research context and methodology

2.1. Adaptation, adaptive capacity and resilience of social–ecological systems

The methodology used in this paper is based on the concepts and some methods of *anticipatory adaptation*, *adaptive capacity* and *resilience of social–ecological systems*, and also refers to the literature on *sense-making* for future adaptations. In the Third Assessment report of IPCC (IPCC TAR) (IPCC, 2001) *adaptation* is any 'adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.'

Adaptations can be *autonomous* and *planned*. Metzger and Schröter (2006) defined *autonomous adaptations* as 'a part of the internal feedbacks in the human–environment system and its subsystems like ecosystems and markets, such as when forest tree species extend their bioclimatic range due to evolutionary adaptation, or the slowing of demand after price increase resulting from supply shortages.' In contrast, *planned adaptation* can 'take place locally, as adaptive management decisions by individuals or small planning groups, such as planting a drought resistant crop type' (Metzger and Schröter, 2006). *Anticipatory adaptations* are designed to react on information about future vulnerability, while *reactive adaptations* occur in response to an experienced hazard. Any planned adaptation is anticipatory, as it results from deliberate decisions based on information about expected impacts, whereas autonomous adaptations can be either reactive or anticipatory, but they do not directly address climate change and occur in relation to other processes in society or to expected risks (Füssel and Klein, 2006). As an example of an anticipatory adaptation, Howe (2011) analysed the preparedness of business organisations for hurricanes; he found that in large companies anticipatory adaptations were more likely to occur than in smaller companies, because large organisations usually create many processes that eventually result in autonomous adaptations.

IPCC TAR (2001) defines *adaptive capacity* as the 'potential, capability, or ability of a system to adapt to climate change stimuli or their effects or impacts.' The Millennium Ecosystem Assessment (2005) further specifies who is involved in the process and in its definition this is the 'general ability of institutions, systems, and individuals to adjust to potential damage, to take advantage of opportunities, or to cope with the consequences.' While adaptive capacity depends crucially on the time

and geographical scales of reference, it often has considerable spatial variability within a system (Alberini et al., 2006), and even in areas where adaptive capacity is expected to be high throughout, some localities can be critically vulnerable to climate change (Metzger and Schröter, 2006).

IPCC TAR (2001) offers the following determinants of adaptive capacity: economic resources, technology, information and skills, infrastructure, institutions and equity. Commenting on them, Adger and Vincent (2005) observed that '...many researchers agree that it would be useful to produce indicators/indices of adaptive capacity for the purpose of understanding its determinants and prioritizing interventions.' Alberini et al. (2006) agreed that it is 'difficult to empirically measure adaptive capacity and establish the relative importance of the factors identified by the IPCC' and suggested to transform the IPCC determinants into eight broad classes to make them more specific: (i) available technological options, (ii) resources, (iii) the structure of critical institution and decision-making authorities, (iv) the stock of human capital, (v) the stock of social capital, including the definition of property rights, (vi) the system's access to risk-spreading processes, (vii) information management and the credibility of information supplied by decision makers, and (viii) the public's perceptions of risks and exposure.

The links between adaptive capacity and governance of social–ecological systems have been explored by Plummer and Armitage (2010). They argued for the importance of the social dimension of adaptive capacity that is driven by formal and informal institutions, as well as by the dynamics of governance and biophysical systems interacting on multiple levels. These issues were further explored by Ekstrom and Moser (2014) in their analysis of adaptation processes in the San Francisco Bay Area, California, USA. Specifically, they proposed a diagnostic framework to identify barriers to adaptation, the role of leadership and *adaptation deficits*, the latter defined as 'a gap between what might be considered a well-adapted society to the existing climate and the actual and inadequate adaptation achievements of that society.' In their analysis of social vulnerability to climate change, Adger and Kelly (1999) emphasised the importance of both individuals and institutions in adaptation: 'capacity – put positively, the ability to respond, to cope and to adapt – should move centre stage in any policy-relevant analysis of vulnerability to climate change.'

Adaptive capacity is directly related to the concept of *resilience*. According to Holling (1973), it 'determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes of state variables, driving variables, and parameters, and still persist.' The IPCC (2001) clarifies, in the Third Assessment Report, that resilience is the 'flip side of vulnerability—a resilient system or population is not sensitive to climate variability and change and has the capacity to adapt.' (IPCC, 2001). Olsson et al. (2006) used resilience perspectives for analysing transformations of social–ecological systems under external stress. In particular, they emphasised the importance of *shadow networks*, which are the informal networks that '...facilitate information flows, identify knowledge gaps, and create nodes of expertise of significance for ecosystem management that can be drawn upon at critical times' (Olsson et al., 2006) and argued for leadership as the central component of a successful transformation. *Leadership* as a factor of adaptive capacity was further explored by Ekstrom and Moser (2014), who recognised both the situations when leadership is helpful in the adaptation process, and when it can be an obstacle. Another fundamental property of resilient systems is the ability to learn from disturbance (Carpenter et al., 2001). To explain the paradox of learning in complex governance systems, Connor and Dovers (2004) recognised four different types of institutional learning: instrumental (focusing on particular policy instruments), government (focusing on organisational dynamics), social (focusing on policy goals and policy problems as social construction) and political (focuses on advocacy coalitions) learning.

The role of sense-making in facilitating future adaptation was first recognised by social anthropologists (Geertz, 1979) and organisational scientists (Weick, 1995), who gave rise to its application in the fields of corporate management (Henfridsson, 2000), psychology and mental health (Maguire et al., 2011; Coleman and Neimeyer, 2010), sports (Macquet and Kragba, 2015), and most of all, in various branches of adaptation and rehabilitation medicine (Williams et al., 2014; Ownsworth et al., 2011; Eman, 2012). Most studies focused on individuals or relatively small groups trying to make sense of stresses and adapt to a new situation or to future stresses. This can be a reason why sense-making research is still uncommon in vulnerability and adaptation research, where the most common scale is a local community, while it can be as big as a region or even a country.

An interesting reconceptualisation of the sense-making framework was brought forward by Linnenluecke et al. (2012), who proposed a framework of organisational adaptation and resilience, set it for extreme weather events and demonstrated how unfolding disaster and post-disaster processes are reflected in future adaptations, and how the learning effect can be enhanced. It recognises five stages organised as a cycle: (1) anticipatory adaptation, (2) exposure, (3) recovery and restoration, (4) post-impact determination of the organisation's overall resilience and (5) future adaptation. All the stages include ongoing sense-making. Granderson (2014) stretches the concept to the community level, and draws direction for interpretative social science research '...for capturing and problematising the ways of knowing, sense-making and mobilising around risks from climate change'. Both papers broadly refer to the methods and terminology of resilience and adaptive governance, and convincingly demonstrate how cultural, political and organisational dimensions shape climate risk management at the levels of organisations and communities.

2.2. Data and methods of data collection

This study is based on a content analysis of semi-structured interviews, national (7 newspapers, 2 TV channels and 4 internet portals) and local (3 newspapers, 2 TV channels) media (all the news features, podcasts and on-line reportages featuring Xavier, including the discussions of lessons learned), social media content (thematic groups in social media,

discussions attached to analysed media features, dedicated on-line forums on national internet news portals – http://www.tut.by/, http://www.onliner.by/, http://telegraf.by/), websites of state agencies, NGOs and interest groups involved in the disaster response and the follow-ups, national legislation, relevant strategies, policies and guidelines. The data and evidence were structured around the three topics: (1) performance and actions taken by state and non-state actors during the snowstorm and on the coming day (including the media coverage), (2) post-disaster restoration and reorganisation, and (3) sense-making and the development of directions for future adaptation.

In total, we interviewed 23 people (including a married couple accounted for as one person), proportionally representing different social and professional groups that suffered from the hurricane, that were involved in disaster response activities, or in post-disaster discussions and actions (see Table 1 for the full list of interviewees). All the interviews were face-to face and lasted from 15 to 75 min. We offered open-ended questions to encourage full, meaningful answers and to obtain more details and coverage of related issues and circumstances. The interviews took place from May, 2013 to September, 2014.

The snowstorm, including the activity and passivity of all involved is extremely well documented by mass and social media, with official reports from disaster response and meteorological services, road police, and state- or municipally-owned utility companies released soon after the event. For the purposes of the study, all the significant events (including meteorological events) that occurred in Minsk and Mahilioŭ on March 15–16, 2013 were put on a timeline, with particular attention paid to what was done or communicated by the key actors and how other actors reacted. In the cases where social and many 'regular' media gave very emotional and often biased or exaggerated accounts of what happened, we tried to use at least three sources of information to validate each significant episode, including eyewitnesses.

Table 1
List of interviewees.

Interview, id	Interviewees	Description	Time of interview
1	Driver of a passenger mini-bus, Mahilioŭ	Man, aged 30–35, was on duty during the snowstorm, on March 15	15 of May 2013
2	Driver of a mini-bus, Mahilioŭ	Male aged 30–35,was on duty during the snowstorm on March 15; after his shift volunteered for excavating cars and rescuing car drivers on March 15–16	18 of May 2013
3	Taxi drivers, Minsk	2 males aged 30–40; were on duty during the snowstorm on March 15	19 of May 2013
4	Eyewitnesses, Mahilioŭ	A female and 2 males aged 50 and 30–60; travelled home on the afternoon of March 15, and got affected by the public transportation collapse	15 of May 2013
5	Eyewitnesses, Minsk	A female and 2 males aged 25 and 30–60, travelled for business purposes and then home during the snowstorm on March 15	18 of May 2013
6	Officer (territorial office of the Ministry of Emergency Situations, Mahilioŭ)	Male aged 40, was on his regular duty, was not directly involved in any rescue operations; he did not experience any difficulties with getting home, as he lived nearby; was very defensive of the action by his agency	24 of September 2014
7	Senior citizens, Mahilioŭ & Minsk	3 females and 1 male aged over 60 staying home during the storm and commenting on work of municipal services and grocery delivery on March 15–19	20 of May 2013
8	Employee of a communal services company, Mahilioŭ	A female aged 60; she was cleaning the street during the snowstorm on March 15, and was removing the snow for several days after the storm was over; complaining over the quality of work environment and no reward for her extra work	21 of May 2013
9	Car drivers, Mahilioŭ	A married couple aged 30; they were taking a relative with her new-born child from the maternity hospital, and got stuck in traffic jams	15 of May 2013
10	Car driver, Minsk	Male aged 40; tried to travel for family matters around the city during the snowstorm on March 15	5 of May 2013
11	Representative of Hydro-meteorological Centre, Mahilioŭ	Female aged 50; she was in her office during the snowstorm on March 15; she did regular meteorological observation routine, and was defensive of her organisation	10 of October 2013
12	Representative of Energy Efficiency Department, Mahilioŭ	Male aged 40; worked in the downtown on March 15 and had difficulties with getting home to city outskirts; as his department is not involved to issues of energy supply he did not feel restrained to criticise other departments dealing with energy security and emergency works	28 of December 2013
13	Representative of City Administration, Mahilioŭ	Male aged 40; was in charge for snow cleaning in some parts of the city on March 15, and although he got home with major difficulties, he avoided any criticism of emergency response and municipal services	25 of May 2014
14	Pedestrian, Mahilioŭ	Female aged 30; was travelling home through the downtown area on the afternoon of March 15; had major difficulties with getting through, and participated in pushing a trolleybus up the hill	15 of May 2013
15	Pedestrian, Minsk	Male aged 30; was travelling back home from his office on the afternoon of March 15; could not take his bus, as the bus line stopped working	15 of May 2013

The methodology used for the description of the post-disaster restoration was largely the same; the main difference was that most information came from the official media, statements and press releases, while social media was used in a limited extent. This was due to apparently (and understandably) less vivid interest by the broader public in the events of this phase, and also because most post-disaster restorations, in particular within organisations, were not reported in the media.

The process of sense-making for future adaptation appeared to be even less transparent. Our evidence is entirely based on interviews and, where possible, on internal instructions and guidance. Most documents are confidential, however, in a few instances their contents were disclosed through interviews or we were allowed a quick glance. If documents were not even allowed to be screened, we double-checked their main points with at least one more interviewee. The stories of sense-making and its media coverage were developed for most of the important organisations involved in disaster response and recovery, and set against expectations and post-disaster reflections of other actors.

3. Resilience and the governance system

3.1. Governance infrastructure

Policy infrastructure for the prevention and management of extreme weather events in Belarus is based on the Act on Protection of Population and Territories from Emergency Situations of Natural and Technogenic Character (1998), the Act on Governmental Bodies and Divisions Concerned with Emergency Situations in Belarus (2009), the Act on Hydrometeorological Service (2006), the Act on the State Mobilisation and Material Reserves (2008), and several other legal acts regulating specific sectors, occupational health and safety issues, local self-governance, use of police and military services and others. Many more regulations, instructions and guidelines issued by national, regional and local governmental bodies set implementation mechanisms, including specific task and responsibility distributions, budget allocations and communication channels.

According to the legislation (Act on Governmental Bodies and Divisions Concerned with Emergency Situations in Belarus, 2009), the overall and full responsibility for coordination of all the actions related to extreme event prevention and management in Belarus lies with the Ministry of Emergency Situations. According to internal regulations (Ministry for Emergency Situations, 2015b), the Ministry shall use all possible telecommunication channels, to notify other governmental bodies and the population about coming extreme events. The decision on recognising weather events as extreme is based on information from the national meteorological service. Forecasts and weather warnings are distributed according to an approved list of governmental bodies (including regional and local authorities) and shall include a 'hazard class' based on the estimated salience of the weather event.

Governmental bodies responsible for public security and critical infrastructure, such as the Ministries of Energy, Transport and Transport Infrastructure, Interior, and Municipal Management respond to critical situations according to their internal regulations (Act on Governmental Bodies and Divisions Concerned with Emergency Situations in Belarus, 2009). They have certain flexibility for taking decisions in respect to disaster response measures. Such decisions should not require more resources than allowed by usual operational budgets (the budgets normally include extra costs associated with the usual winter irregularities), and once this limit is reached the agencies cannot proceed without a special communication from the Ministry of Emergency Situations. In extreme situations the Ministry makes available resources and equipment accumulated in special storages (Gosrezerv).

Likewise, regional and local authorities are allowed to modify their routine in response to extreme events only after having received a communication from the Ministry of Emergency Situations (Act on the State Mobilisation and Material Reserves, 2008). Interviewees representing emergency response bodies not belonging to the Ministry of Emergency Situations (interviews 6, 11, 12, 13) emphasised that in the case of an extreme situation, they shall obediently follow their internal regulations. If a certain situation is not regulated by internal guidelines, then they have to wait for a communication from the Ministry of Emergency Situations.

The Council of Ministries and the president are given many functions related to the management of extreme events by the national legislation, for instance, rights to recognise 'extreme events', to release resources of the Gosrezerv to facilitate large-scale response actions or to involve military forces (Act on the State Mobilisation and Material Reserves, 2008). In Belarus, with its longstanding traditions of blame management (Otto et al., 2011), this greatly restrains the flexibility of the Ministry of Emergency Situations (interview 6).

Although Belarusian legislation encourages involvement of non-state actors in all stages of the management of extreme events (Act on Protection of Population and Territories from Emergency Situations, 1998; Act on Governmental Bodies and Divisions Concerned with Emergency Situations in Belarus, 2009), the actual evidences of such interactions are very few (Ministry of Emergency Situations, 2015a). In January 2013 the Ministry announced on its website an initiative titled, 'become a volunteer of the Ministry of Emergency Situations'; the initiative addressed 'those sharing the objectives of the ministry'. To become a volunteer, one had to fill in an online application form. No other information about the initiative is available online; there were six updates on the initiative published on the ministry's website in 2013 (including the announcement and the first call for applications), and no updates during 2014 (as of December 1, 2014). The overall structure of governmental organisations dealing with extreme weather events in Minsk and Mahilioŭ is described by Fig. 1.

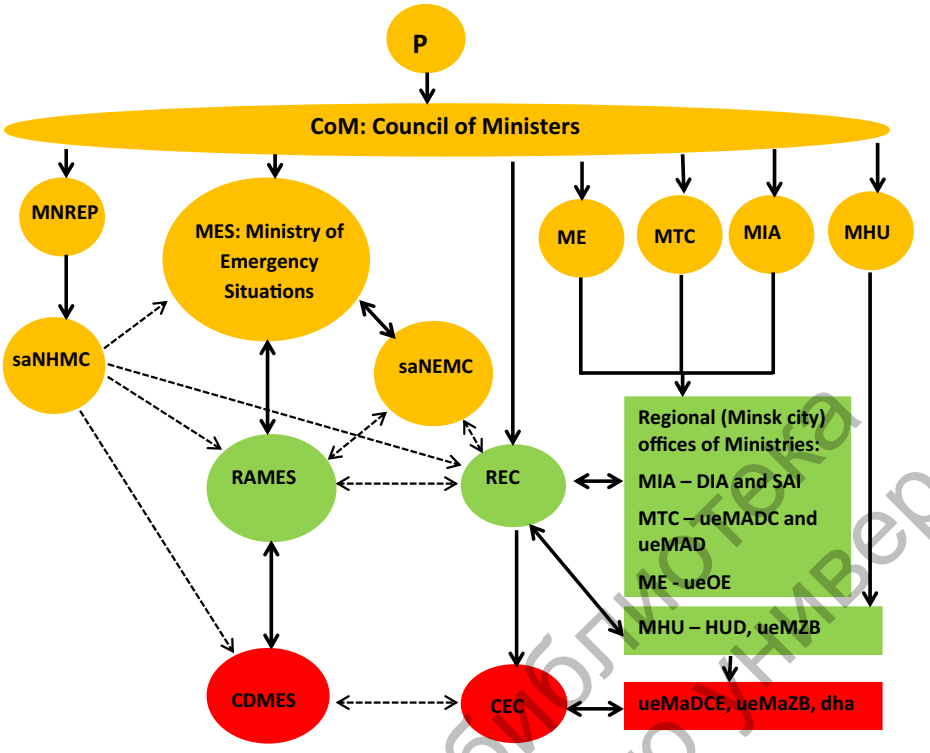

Fig. 1. Configurations of state actor networks for mitigating extreme weather events in Belarus. Abbreviations: P – President of the Republic of Belarus, CoM – Council of Ministers, MES – Ministry of Emergency Situations, MNREP – Ministry of Natural Resources and Environmental Protection, ME – Ministry of energy, MIA – Ministry of Internal Affairs, MTC – Ministry of Transport and Communications, MHU – Ministry of Housing and Utilities, saNHMC – State Agency "National Hydrometeorological Center", saNEMC – State Agency "National Emergency Management Center", RAMES – Regional (Minsk city) Administration of the Ministry of Emergency Situations, CDMES – City Department of Ministry of Emergency Situations, REC – Regional (Minsk city) Executive Committee, CEC – City Executive Committee, DIA – Department of Internal Affairs, State Automobile Inspectorate, ueMADC – UE "Minskaŭtador-Centr", ueMAD – UE "Mahilioŭaŭtador", HUD – Housing and Utilities Directorate, ueMZB – UE "Minskzielianbud", ueMaDCE – Unitary Enterprise "Directorate of Communal Enterprises", ue OE – Unitary Enterprise "Oblenergo", ueMaZB – UE "Mahilioŭzielianbud", dha –housing association of a city district (9 in Minsk, 2 in Mahilioŭ). Line types: solid – strong connection (e.g. direct subordination), dashed – weak connection (e.g. information exchange during extreme weather event). Node colours: yellow – national level, green – regional level, red – local level. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

3.2. Impact, sensitivity and emergency response by state actors

Although snowstorms comparable to Xavier were observed in different parts of Belarus in 1966–1971, 1973, 1983, 1989, 1992, 1993, 1996, 1998, 1999, 2001, 2003–2005, and 2007–2010 (Loginov et al., 2010), March 2013 was the first time that anything comparable occurred in Minsk or Mahilioŭ.

The cyclone Xavier came to Belarus on March 15, 2013, moved through regions of Minsk and Mahilioŭ with an average speed of 80 km/h, and left the country on the night of March 16, 2013. Within 12 h the snow thickness grew from 45 to 57 cm in Minsk and from 42 to 58 cm in Mahilioŭ (i.e., about a half of the annual average for the total snow cover); the average precipitation intensity during the snowstorm was 1.7 mm/hour (the annual average for snow precipitations is 0.18 mm/hour); the day's lowest temperatures were −6 °C in Minsk and −4 °C in Mahilioŭ (see Fig. 2 for an overview).

A weather warning by the Hydrometeorological Service was issued and delivered by March 14, 2013, however, the forecasted weather conditions were not classified by the service as a 'hazardous event' until midday on March 15, 2013, when the snowstorm was already approaching (interview 6). Once the Ministry of Emergency Situations was told about the 'hazardous' status of the event (at 12:38 pm (interview 6)), it proceeded strictly according to relevant regulations (Procedure for the Collection of Information, 2001): all the organisations and media included on the approved list were informed within 10–15 min, and the state of full alert was announced to relevant units of the ministry; in order to proceed further with planning and implementing the action, the ministry needed feedback from local authorities on the scale and saliency of the event. Our interviewee that works in the ministry (interview 6) supposes that, in the first place the reports were too optimistic to give a full overview of the magnitude and potential damage, or they were considerably delayed, probably in order to avoid responsibility for excessive alarmism. As a result, the ministry did not get sufficiently documented justification for announcing an emergency situation, and in fact, Xavier has never been officially recognised as such (EUROBELARUS, 2013), although a governmental commission to manage the situation was eventually setup on March 15th round 8:00 p.m. (BelaPAN, 2013d).

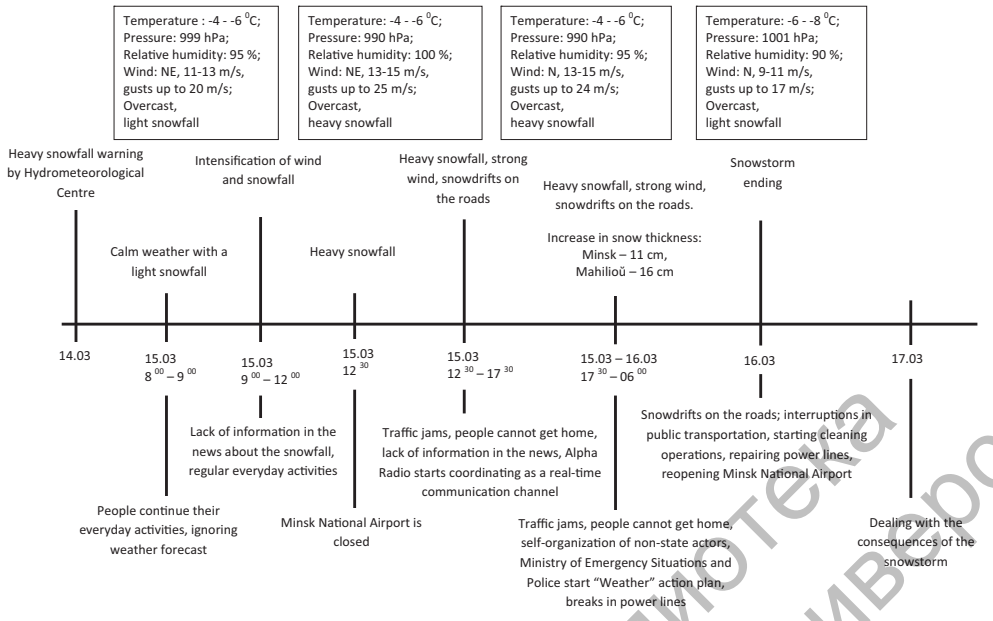

Fig. 2. Overview of the snowstorm of March 15–16, 2013 in Minsk and Mahilioŭ.

Another reason possibly explaining such a slow reaction and weakness of the governmental bodies is that all the key governmental officials, including the president, prime minister, first vice prime ministers and most of the ministers were abroad on March 15–16, and no officials remaining in Belarus wanted to take the risk of recognising the coming, and then unfolding, snowstorm as an ‘extreme’ event, for fear of being wrong (Bykovskij, 2013). The interviewees argued (interviews 11, 12, 13) that this could have prevented the state bodies from organising a timely and sufficient response outside the usual bad weather routine, or at least from ending office hours and classes on Friday a few hours earlier (TUT.BY, 2013e).

As a result, until midday on Friday, March 15, 2013, the only visible reaction to the weather warning from the side of public authorities was a recommendation from the road police on the news programs of national and regional state-owned TV channels on March 14th to refrain from using cars on the 15th (Bykovskij, 2013). As observed by interviewees (1, 2, 3, 4, 5, 9, 10, 14, 15) and social media (Ryzhenkov, 2013), this warning was not really noticed by the target audience. Despite the warning, all the state organisations and services acted as usual, for instance, office and class hours were not shortened to let people get home before the snowstorm began and unfolded (Bykovskij, 2013), e.g., it was only round 6:00 p.m. on March 15th that the Ministry of Education issued a communication that in Minsk and Mahilioŭ school classes would be dismissed for the day and cancelled for the following day, Saturday (March 16, 2013) (BelaPAN, 2013b).

The National Airport Minsk was closed at 12.30 p.m. (BelaPAN, 2013m); by 4.30–5.30 p.m. heavy snowfall caused major interruptions on all the ground public transportation lines (buses, trolleybuses, trams) in Minsk and Mahilioŭ, and by 6:00 p.m. all the public transportation stopped functioning, except the Minsk underground (the Metro), where the frequency of trains was increased. Around 7:00 p.m. units of police were sent to the busiest stations to prevent crowd jams at metro entrances (BelaPAN, 2013u). Hundreds of thousands of people, including children, had to walk kilometres through the snowstorm to get home. From 6:00 to 7:00 p.m., main streets and highways in the cities and on their peripheries were becoming blocked with cars, especially on the roads used by lorry tracks (interviews 3, 4, 5), and after 7:00 p.m. the road police started to block city exits (Ryzhenkov, 2013). Many cars were abandoned, while thousands of drivers had to stay with their cars because they did not have winter clothes or could not get out from their cars (Ryzhenkov, 2013; BelaPAN, 2013a).

Municipal services in Minsk and Mahilioŭ, and the emergency division of the ministries for energy and transportation, responded the way they were prepared to respond to regular snowstorms. The action plan called ‘The Weather’ was launched, and a total 4093 units of road equipment and 20,767 people were reportedly employed to clean roads in the two cities and elsewhere in the country and 5224 instances of major electricity network failures were fixed (BelaPAN, 2013c). Social media contributors anonymously agreed that municipal services and the road police made a very impressive effort on March 15–16, but it was not enough to manage the problem (BelaPAN, 2013o,q). The Ministry of Emergency Situations was providing hot meals and beverages along blocked highways, while excavating cars from snowdrifts and moving them to roadsides. There were 200 reported cases of people being saved from snowdrifts (total 1200 persons saved) (BelaPAN, 2013e). On the 16th, military forces joined in rescuing and road cleaning operations (BelaPAN, 2013g).

Municipal public transportation resumed most services on the afternoon of March 16th, although up to 80% of suburban bus lines still could not serve their whole routes (interviews 1, 2, 7, 8), and until the 17th social media contributors complained of city and suburban buses not reaching their terminus stops (BelaPAN, 2013l). According to the comments

on news articles (also interviews 1, 2), there were problems with disposition of garbage from residential areas and with deliveries of groceries on the 17th and even the 18th (TUT.BY, 2013a). Although, according to the Ministry of Emergency Situations all the roads were clean as of March 17th (Ministry of Emergency Situations, 2013b), social media contributors pointed out that it was rather the 19th (TUT.BY, 2013b; BelaPAN, 2013k).

3.3. Critique of the state agency

Independent and social media, and interviewed witnesses observed that arguably the biggest problem with facing the hurricane and responding to it, was the fact that information about the coming disaster was not properly communicated and explained by responsible governmental bodies through state-owned media (which includes almost all the major periodicals and all the national and regional TV channels), and as the event unfolded no further information was provided to help the people understand the full scale and magnitude of the snowstorm, as well as what to do to avoid the risks and/or to help (Ryzhenkov, 2013; Bublikava, 2013; interviews 4, 5, 9, 10, 14, 15).

The first time the snowstorm was mentioned was on the evening TV news features on March 15th; the first national channel gave a general overview of the snowstorm and its consequences, with the major message being that most of the problems were caused by careless and irresponsible car drivers who took their cars on this day, in spite of explicit warnings from the road police. On the next, day the news program's message was repeated and even further developed (Bublikava, 2013). National and regional state-owned periodicals and other TV channels took the same line of communication, failing all expectations that they would provide useful information.

The webpage of the Ministry of Emergency Situations contains six updates posted on March 15–16 related to the snowstorm; of those, only the entry of March 16th, at 1:00 a.m. (Ministry of Emergency Situations, 2013a) looks really useful, as it lists locations where hot meals and beverages were provided. It is not easily searchable, though. Other communication channels were not used either. The phone lines of the police and the Ministry of Emergency Situations were permanently busy, no easily available information was distributed on what was being done to rescue people trapped by the storm and how to get help (interviews 4, 5, 9, 10, 14, 15).

Police units blocking the metro and highways avoided any explanations. On one hand, nobody was surprised, as this is not unusual for police in Belarus, but on the other hand the suspicion was that they were not fully informed themselves (interviews 9, 10). It was only after 10–11 p.m. on the 15th (in Mahilioŭ) that instead of saying that the passage was forbidden, they started to add that the road ahead was blocked (Ryzhenkov, 2013). On the afternoon of the 16th, the mayors of Minsk and Mahilioŭ (and the president on the 17th (BelaPAN, 2013v)) called for volunteers to help with cleaning courtyards and driveways (BelaPAN, 2013t; TV and Radio Company 'Mogilev', 2013), however, this seemed to be the only communication from high officials addressing snowstorm-related practical issues.

3.4. Emergency response by non-state actors

In contrast, the performance of non-state actors, including formal and informal networks, and non-state-owned companies, exceeded expectations of observers familiar with the Belarusian socio-political and socio-economic context (interviews 1–5, 9, 10).

FM Stations and online portals started to collect and publish information about massive traffic jams as soon as they started after 4:00 p.m. on the 15th, and as the hurricane unfolded this took a more systematic and organised form. National online news portals, tut.by and onliner.by, created dedicated webpages and mobilised their networks to provide real-time information on traffic and available routes, mobility options, and later also on volunteer accommodation and catering arranged by the Ministry of Emergency Situations (Tovarishch.online, 2013); tut.by also maintained an editable online table, where everyone could add information about the assistance requested and available to offer (Bykovskij, 2013). The FM station Alpha Radio (http://www.alpha.by/) switched from their usual 'a lot of music and a bit of optimistic news' format to a functional real-time communication channel for those trapped in snowdrifts, those looking for friends and relatives they could not reach by phone, or those willing to help (STV, 2013a). An important detail to note is that the independent media had not been approached or fed critical information directly by the Ministry of Emergency Situations or the police, but had to make regular inquires to their central administrations and territorial divisions (Bublikava, 2013).

As the snowstorm developed and the situation on the roads was getting worse, the citizens of Minsk and Mahilioŭ showed a lot of will to help, and much more potential for self-organisation than was believed possible to expect from the Belarusian society (interviews 4, 5, 9, 10, 14, 15). Groups of volunteers with shovels had organised through social media and patrolled streets and courtyards in their cars to excavate vehicles blocking passages and driveways and offering hot beverages and phones to call car drivers (STV, 2013a). More formal organisations, such as Jeepers clubs in Minsk, searched for blocked cars on the city's outskirts and highways, helped them to get out from snow and from roadsides (even a few ambulance cars and buses) and distributed shovels (Ryzhenkov, 2013). Many car drivers offered a lift to pedestrians, including taxi drivers who often offered free or discounted rides (TUT.BY, 2013c; STV, 2013a; interviews 1–5,9, 10, 14, 15) (although instances of extra-exuberant taxi fares have also been reported (TUT.BY, 2013h)).

3.5. Sense-making and post-disaster developments

Although the salience of the snowstorm was well above anything normally expected in Belarus, the opinion shared by many social media contributors and selected experts (e.g., interviews 6, 8, 9, 11, 12, 13; Shirvel, 2013; BELTA, 2013; TUT.BY, 2013d) was that the level of behavioural and technological adaptation was, in principle, sufficient for Xavier to pass with not much difference in impact from any other heavy snowfall event, and it was the state agency that failed to communicate critical information and arrange timely responses. Although people we very angry, this opinion did not seem to result in any organisational changes.

Non-state actors and formal networks involved in rescue operations did not come up with any policy proposals or organisational developments either, and shortly after the snowstorm such opinions could be heard from the leaders of volunteer groups who had helped out on the nights of March 15–16: '*. . .smooth interactions between volunteers and governmental bodies shall be organised – tell us, where is the problem, where to go, and what to bring with us; volunteers do not claim to be universal life rescuers – there are professionals for that; but at least we can help people with hot tea, meals, water, fully charged cellular phones, or some words of support – please, do not put barriers to what we can do; please, DO NOT TAKE IT FOR AS WE WANT TO CRITICISE THE AUTHORITIES – we only want to tell that we want to help you (the authorities)*' (TUT.BY, 2013f).

There are some evidences of modified behaviour after the snowstorm. Most of these concerned car drivers. According to interviewees and social media contributors, at least in the winter of 2013/14, more drivers filled their full fuel tanks in the winter, wore or took warm clothes and shoes to the car, tried to arrange cellular phone chargers in cars and made sure that they had basic emergency equipment in their cars (interviews 1, 2, 9, 10) than in previous years. Based on the experience of Xavier, many car drivers, however, seemed to contest the recommendation to refrain from taking personal cars on days with a snowstorm warning. This was done on the grounds that public transportation is even less functional on such days, and that when taking their own car they also could give a lift to other people (Andrejeva, 2013). There were many evidences that people started to take warnings from the Hydrometeorological Service more seriously , however, after several less-vivid-than-expected snowstorms (forecasted to be of a similar magnitude as Xavier), this behavioural pattern tended to disappear (Savich, 2013; Korsak, 2014).

The processes of organisational recovery and sense-making in governmental bodies responsible for critical information and management of extreme events were not open to public. On one hand, official communications from all the organisations stated that they performed well during the snowstorm, with all the protocols and instructions strictly followed (e.g., Shirvel, 2013; BELTA, 2013; TUT.BY, 2013d). On the other hand, they also mentioned that there were messages worth taking, however, they were either very minor or not directly related to the area of responsibility of the particular organisation. Here is an example of such a self-assessment from the Minister for Emergency Situations: '*. . .good coordination of our action was instrumental in managing the situation, although the fact that many people had spent in traffic jams from 10 to 15 h certainly indicates that there are some issues we still have to work on*' (STV, 2013b).

Along the usual lines about efficient and well-coordinated work during the snowstorm, some interviews included reasonable observations and useful specific suggestions. The head of the division for road maintenance at the national road administration (Belaŭtador) noted a few weeks after the event that '*safety modes on the roads shall be clearly recognised and put into a regulation. Say, under the "red" mode only road maintenance cars shall be allowed, under the "orange" one also cars of other special services. . ., but what happens here now? Car drivers get recommendations to refrain from rides with each storm warning, which are happening dozens of times a year. . .*' (Golovnev, 2013). This comment, the same as other similar comments from representatives of governmental bodies and non-state actors, either was not translated into specific policy proposals, or if such proposals were made, they were never accepted.

There are several press-releases, communications or news items by the Ministry of Emergency Situations, where the lessons taken after Xavier are mentioned (STV, 2013b; Sukharevich, 2014). Apparently, the lessons were included into the agenda of several meetings by the Council of Ministries and the Ministry of Emergency Situations, however, only the dates and topics of such meetings can be traced in the public domain. The lists of the lessons are neither long nor specific, and not really different from regular 'pre-Xavier' routines. The key documents regulating collection of information about an approaching or unfolding extreme event and its management have not been updated. Some other relevant regulations and instructions have been modified, and they suggest that the most important sense-making developments were:

- Classification of weather events by the national hydrometeorological service using colour codes, and communicating the colour-coded levels of danger not only to governmental bodies but also to the public (Lomonovskaya and Mozhejko, 2014).
- Training of the Ministry of Emergency Situations staff on actions in heavy snowstorm conditions (Sukharevich, 2014).
- Adapting more specific action plans for heavy snowstorms of dangerous levels (orange and red) (Lomonovskaya and Mozhejko, 2014).

4. Resilience, mal-resilience and implications for adaptive capacity

Young (2010) argued that environmental and resource systems have difficulty responding promptly to abrupt socio-ecological changes "...even when the growing mismatch between prevailing institutions and the changing character of biophysical and socioeconomic systems becomes a matter of common knowledge" (Young, 2010). This argument is fully

supported by our analysis of Xavier and its consequences. Apparently, one of the chief reasons for the inadequate reaction by governmental and non-governmental institution to the lessons of Xavier was the overall perception that the situation was rather accidental than consistent with the structure and properties of the governance of extreme events in Belarus. Our study identified a number of structural issues in the institutional design that are compromising the ability of the governmental agency to face some of unexpected challenges, and the low capacity of the broader governance system to recognise and address possible learning outcomes.

4.1. Critical institutions and decision-making authorities

Similarly to the observations of Ekstrom and Moser (2014), the most important barriers to adaptation identified by our study had to do with institutional and governance issues, leaving behind resource constraints, scientific and technological issues. Governance by the state, in particular the structure of critical institutions and decision-making authorities, seemed to be the most problematic, apparently due to the prevalent top-down institutional design, some institutional legacies and overall overregulation of the management of extreme events.

As we observed in Section 3.1, historically, the background of the Belarusian Ministry of Emergency Situations is the supervision of fire departments. In this specific organisational culture only high-magnitude disasters really count, especially human-caused ones. In Belarus, with its mild temperate climate, high-magnitude weather extreme events are rare, and although their frequency is increasing (Loginov et al., 2010), before Xavier of March 2013 heavy snowstorms were not perceived as important enough to address beyond the regular winter routine, and definitely were not considered as an occasion to announce an emergency situation. This is also reflected in staff training programs, disaster response protocols (e.g., the main protocol for extreme weather events (Procedure for the Collection of Information, 2001) does not even mention heavy snowfall and has not been changed since 2012 (as of September, 2015)), communication strategy and even in available technical means (they had only two off-road vehicles with low-pressure tiers (Bykovskij, 2013)). This represents a functional misfit (Ekstrom and Young, 2009), as the situation needing to be managed does not fit the agency in charge.

In the analysed situation, the delayed reaction of the Ministry of Emergency Situations was also holding back the governmental bodies that routinely dealt with heavy snowfalls and snowstorms and their consequences, such as the Ministry of Energy, the national road administration (Belaŭtador), road police, and municipal services. This represents a horizontal institutional interplay (Young, 2002).

The top-down governance model in Belarus, in addition to institutional monocropping (Evans, 2004; Shkaruba and Kireyeu, 2013) and degraded leadership, also causes several vertical institutional interplays. The Act on the State Mobilisation and Material Reserves (2008) appoints the Ministry for Emergency Situations as the coordinating organisation for preparing and managing any extreme events. At the same time, it also introduces the president and the Council of Ministers as policy setters in the field, and also entitles them to manage high-magnitude extreme events. The areas of responsibility are overlapping, which restrains the ministry's flexibility to take critical decisions, especially if the situation in question is new and there are no approved protocols to refer to. As a sense-making outcome of Xavier, such protocols had been developed by the end of 2013, however, the overall ambiguity in task division is still there.

The learning experience provided by Xavier could be a good opportunity to reduce the adaptation deficit, however, the outputs of the sense-making process suggest that although some procedures have been revised, major changes in decision-making processes did not occur, i.e. adaptation deficit was closely related to the limited ability for institutional learning. This is related to the fundamental issue of 'where accountability lies' (Caney, 2010) and 'who bears responsibility for action' (Granderson, 2014). The failure to respond and the need to take major lessons from the failed action were not properly recognised by the government. In spite of massive criticism of the ministry during and after the snowstorm, nobody was fired or even given a rebuke. Moreover, the ministry was commended by the president and the prime minister for its work during Xavier (Bykovskij, 2013), while the event itself, after the initial shock, was greatly underplayed by the presidential and government spokespersons (TUT.BY, 2013g).

4.2. Social infrastructure

Social networking, institutional variety and the ties between social actors are critically important for facilitating coordinated action in response to extreme events at the community level (Adger, 2003; Olsson et al., 2006; Eriksen and Selboe, 2012). The Belarusian government recognises this too, however, governmental agencies take a very cautious approach when it comes to the action level. Although the total number of NGOs in the country has reached 2521 (as of January 1, 2014; Ministry of Justice (2014)), only a small fraction are active. Most of the largest NGOs (mostly those remaining from the USSR past) serve as outreach departments of ministries or research institutes, and with a few notable exceptions, this is the only type of NGO considered by governmental bodies as trustworthy cooperation partners (Otto et al., 2011). Being governmental departments by their function and organisation, such NGOs, even those concerned with rescuing, military training or youth mobilisation (e.g., DOSAAF, OSVOD, BRSM), did not show up during the snowstorm, at least they were never featured in the news and news forums covering Xavier. A single 'trusted-by-the-government' NGO mentioned in this context was the Belarusian Red Cross, while 'real NGOs' were represented only by Jeepers clubs. Although the latter were very helpful, efficient (and sometimes also better prepared technically then 'official rescuers') and willing to cooperate with the Ministry of

Emergency Situations or other relevant governmental bodies on traffic-related issues (TUT.BY, 2013f), no formal (or publicly announced informal) collaboration ties have been established as of September 2015.

Non-formalised networks and any activities on their behalf are not encouraged in Belarus, neither by the legislation, nor by administrative practices (Otto et al., 2011). None of the interviewees, including employees of the Ministry for Emergency Situations was able to formulate the policy of the ministry in regard to volunteers. The ministry had made an effort to reach volunteers and to institutionalise possible cooperation ties, as we can see from the call for volunteers posted on the ministry's portal in January 2013 (more details in Section 3.1). However, this did not seem to lead to any tangible outputs, as far as we can judge from interviews, and there was zero publicity on any activities involving the 'official' volunteers, including the publicity on Xavier.

Our findings showed that the emergency response efforts of non-governmental actors did not make a case for changing institutional inertia in critical governmental bodies, and post-disaster sense-making did not result in any changes in their approach to NGOs and informal networks. The sense-making process of non-state actors had the same outcomes: they demonstrated plenty of leadership, capacity for self-organisation and strong collective action during the snowstorm, however, this did not last any longer, and specific proposals for better cooperation have never been developed and made known to public. This suggests that although the stock of social capital in Minsk and Mahilioŭ is sufficient for a shadow network (Olsson et al., 2006) to emerge, it is still not sufficient to make such a network sustainable, or at least to capitalise on learning opportunities generated by Xavier. We can speculate though that the snowstorm was just too short, and more time and hardship is needed for a functional shadow network to develop, to adsorb enough human capital and inputs for institutional learning.

4.3. Economic resources, technology, information, skills and risk perception

Publications (including contributions to social media) reflecting on the sense-making process in governmental and non-governmental organisations, in social networks and by individuals, suggest that availability of economic resources, technical means and timely forecasts and warnings were identified as the most important areas to address for strengthening anticipatory adaptation (e.g., Wende et al., 2010; Bobylev, 2013). Very much in line with this, the Ministry of Emergency Situations and other critical agencies did not mention any other issues as recognised and addressed during preparations for the winter seasons of 2013/14 and 2014/15 (e.g., Shantyko, 2013; Shlyk, 2014).

Where economic resources and technological capacity were concerned, all the organisations reported their full preparedness for heavy snowfalls and snowstorms. The agencies concerned with energy supply and roads listed the number of units and pieces of equipment available for use, while communications from the Ministry of Emergency Situations were more ambiguous and only assured that the state's material reserves (Gosrezerv) had '*enough*' machinery and spending materials to face anything comparable to Xavier (Zhivaeva, 2014). Because information about the Gosrezerv is highly confidential, we could not verify this, and for the same reason we could not make any retrospective comparisons. Since no high-magnitude snowstorm events occurred in the next winter (2013/14), the emergency response agencies did not have a chance to test their readiness to perform better.

Except that car drivers and transportation companies started to pay more attention to emergency equipment, no other particular measures of an economic or technical nature were taken by other non-state actors to ensure their anticipatory adaptation, with the Belarus Red Cross being a noteworthy exception (e.g., International Federation of Red Cross and Red Crescent Societies, 2014). Partly, this is because the adaptation repertoire of Belarusian companies and individuals had already been quite well developed, but is probably also due to the traditionally paternalist attitude in Belarusian society. The state is believed to be able to solve any problems, even if the prior experience was not always positive (Smok, 2013). This attitude is a legacy from the Soviet past, and on one hand it was even promoted by the government as a part of the national ID (Knyazev and Reshetnikov, 2004), but on the other hand, under a stagnating national economy, the welfare system inherited from the USSR cannot be supported anymore, and the state often fails to meet the obligations implied by the paternalistic social contract. In this light, relying on the state seems to be a very strong mal-resilient feature, and although non-state actors demonstrated some impressive self-organisation action, it also should be noted that this was not followed-up with a meaningful sense-making process and development of 'safety nets' or other adaptation tools.

As we already mentioned in Section 3.5, after Xavier the system for spreading critical information was somewhat modified, with colour-coded levels of weather hazards offered to public. The value of this development is greatly undermined by the fact that the information about colour codes, or recommendations for extreme weather conditions corresponding to certain colours are not available from any governmental organisation and not searchable online as of December 1, 2014. Apparently, only the road police seems to have functional cooperation arrangements with non-governmentally-owned media, while the Ministry for Emergency Situations tends to avoid, for instance, FM radio stations as communication channels for their warnings and updates.

Similar to other actors, non-state media did not take a proactive position, and did not come up with specific proposals or mechanisms for facilitating the risk-spreading process; at least such efforts have not been revealed to the public. A possible explanation can be found in an extensive analysis of Xavier that was published by the most visited Belarusian news portal, tut.by, two weeks after the snowstorm. The journalist observed that the initiative taken during Xavier by FM station Alpha Radio had never been praised by governmental officials, and he wondered if it would be punished, as often happens with unsolicited initiatives in Belarus (Bykovskij, 2013).

5. Conclusions

Dealing with extreme events is one of the areas where the central role of the government and of top-down approaches are traditionally believed appropriate, for such situations often require a fast reaction and immediate action, which are rarely associated with decentralised and inclusive modes of governance. Belarus is known for its highly hierarchical governance, where all the extreme events are taken care of by a paramilitary agency with a powerful mandate (Ministry of Emergency Situations). Nevertheless, the government failed to manage a heavy snowstorm that occurred on March 15–16, 2013 (Xavier), although it was manageable in principle and forecasted a reasonable amount of time in advance.

Crises in organisation and communications were the biggest issues during the snowstorm, both within the government and to the population and organisations in the affected area. It did not help that initially the Hydrometeorological Service did not classify the forecasted snowstorm as a 'hazardous event', and did not do so until it started to develop on March 15th, so the forecast passed almost unnoticed until it was too late for infrastructure maintenance services to start advance preparations. Nevertheless, the real bottleneck of the decision-making flow was in the stage of collecting feedback from local governments about the unfolding disaster by the Ministry of Emergency Situations: the governments did not want to get accused of overplaying the crisis and submitted somewhat overoptimistic reports, while in the absence of conclusive reports and regulations unambiguously prescribing what to do in case of a heavy snowstorm, the Ministry of Emergency Situations preferred to avoid decisive actions, such as announcement of an 'emergency situation'. Life continued as usual, and the ministry started to act only when Xavier was in full swing, and rescuers were called for.

Although all the relevant governmental organisations had reported about the lessons learned and addressed, there is no evidence that all the lessons worth taking had been actually taken. Only very few specific technical measures were unveiled to the public, while many other obviously (and sometimes heavily discussed in the media) failing routines have never been changed, including communication strategies. The need for changes in legislation and administrative practices (in particular for an inclusive and transparent decision-making process with institutional misfits and overlaps removed) was not recognised by the government. Moreover, top governmental officials praised the work of disaster response agencies during the snowstorm, while self-organisation by local communities was criticised as insufficient.

Sense-making processes by non-state actors and informal networks had not motivated them to take more a proactive position for removing barriers to adaptation, even though strong leadership and the capability for self-organisation were demonstrated during the snowstorm. This is not unusual for the Belarusian political context, where unsolicited private initiatives can be easily labelled as 'political opposition'. Partly, this can be explained by the USSR-inherited paternalistic social contract. A more flattering argument would be that the snowstorm event was too short in duration for functional shadow networks to emerge and develop into sustainable organisational forms.

On the one hand, Xavier was a powerful learning experience for both emergency response organisations and non-state actors. For the latter, an important learning outcome was that private initiatives may work in extreme situations much better and quicker than relevant governmental agencies, while the former acquired some in-hand experience of working under stress, and they realised that the salience of snowstorm events can be great enough to qualify as a 'real' extreme situation. On the other hand, accountability, transparency and allocation problems compromised the sense-making process and acted as barriers to anticipatory adaptation.

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