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EMERGENCY SERVICES ACADEMY FINLAND

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Tiivistelmä

Venäjän laiton hyökkäyssota Ukrainaa vastaan on luonut tilaisuuden tarkastella ja oppia väestönsuojelusta sekä kriittisen infrastruktuurin ylläpidosta ja suojaamisesta nykyaikaisen tavanomaisen sodan oloissa. Ukrainan opit -hankkeen tavoitteena on ollut kerätä havaintoja Ukrainan väestönsuojelun toiminnasta sodan oloissa sekä sodan vaikutuksista Ukrainan siviiliväestöön ja infrastruktuuriin. Näiden havaintojen pohjalta hanke on myös tuottanut toimenpidesuosituksia Suomen väestönsuojelun kehittämiseksi.

Hanke on ollut luonteeltaan kartoittava. Hankkeen puitteissa on kerätty asiantuntijahaastatteluja sekä laaja viranomais-, tutkimus- ja selvitysaineisto. Kirjallinen aineisto on koottu julkisista lähteistä. Haastateltavia on pyydetty raportoimaan ainoastaan julkista tietoa. Aineistolle on toteutettu sisällönanalyysi, jonka pohjalta syntyneet havainnot on esitetty aineistolähtöisesti teemoiteltuina. Toimenpidesuositukset jatkotutkimuksesta sekä kehitystyöstä on tuotettu havaintojen sekä haastateltujen asiantuntijoiden näkemysten perusteella.

Ukrainan opit -hanke ei ole sisältänyt syvällistä Suomen nykyisen väestönsuojelun ja siihen liittyvän suunnittelun kartoitusta. Raportissa esitettävät havainnot ja toimenpidesuositukset on tarkoitettu herätteiksi ja resursseiksi vastuuviranomaisten omalle kehitys- ja tutkimustyölle. Näissä rajoissa tässä raportissa esitetään laaja analyysi Ukrainan väestönsuojelun sodan oloissa kohtaamista haasteista sekä sen toiminnasta.

Raportti ei edusta Pelastusopiston tai sisäministeriön virallista kantaa. Kaikki havainnot ja suositukset ovat nousseet esille Pelastusopiston virkamiesten tuottaman selvitystyön tuloksena. Hanke toteutettiin sisäministeriön pelastusosaston toimeksiannosta Pelastusopistossa.

Avainsanat: Väestönsuojelu, kriittinen infrastruktuuri, puolustustila, Ukraina, Venäjä

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Abstract

The illegal war of aggression the Russian Federation has launched against Ukraine has created an opportunity to study and learn about civil defence and infrastructure protection in the conditions of a modern conventional war. The Lessons from Ukraine -project has gathered observations about the operation of the civil defence of Ukraine as well as the impact the war has had on the civilian population and infrastructure. Based on these observations the project has produced recommendations for the development of civil defence in Finland.

The project has employed an exploratory approach. Its data sources comprise of expert interviews and a large volume of official and scientific documents as well as other reports. All document material is from public sources. Interviewees were instructed not to disclose any classified material and share only public information. Through content analysis a number of observations were produced, which are presented thematically in this report. Additionally, based on the observations as well as expert opinions, a number of recommendations regarding future research and development avenues were produced.

The Lessons from Ukraine -project did not carry out a comprehensive study of the current civil defence capabilities and plans of Finland. The observations and recommendations in this report are meant as a starting point for the development work carried out by government agencies responsible for the relevant functions. Within these limits the report presents a comprehensive analysis on the challenges and functions of Ukrainian civil defence during the war.

None of this report represents the official stand for either the Pelastusopisto (Emergency Services Academy Finland) or the Ministry of the Interior. All observations and recommendations are based on research conducted by government officials at the Pelastusopisto. The report was commissioned by the Ministry of the Interior of Finland.

ABI/INFORM: Civil defence, critical infrastructure, state of defence, Ukraine, Russia

Foreword

The Lessons from Ukraine Project was commissioned by the Ministry of the Interior's Department for Rescue Services. The project was launched in April 2024 and a report compiling its results was completed in March 2025. The project was funded by the Ministry of the Interior and carried out by the Emergency Services Academy.

The project's data collection and interviews as well as the analysis of material concerning Ukraine were carried out by Mikko Räkköläinen, M.Sc. (Econ.) The analysis of the current state of civil defence in Finland was carried out by Dan Sundblom, (M.Soc.Sc). Marko Juutinen (D.Soc.Sc.) was project manager.

The implementation of the Lessons from Ukraine project would not have been possible without the valuable input of numerous experts, for which we would like to express our gratitude. We want to extend a special thank you to those who shared their expertise and time in the form of interviews. We would also like to thank the Ukrainian State Emergency Service (SESU) for their cooperation and assistance. In addition, we would like to thank the experts in the rescue services sector, the Defence Forces, official organisations and the private sector who reviewed and commented on parts of the manuscript. We also appreciate the valuable comments and observations made by expert colleagues at the Emergency Services Academy. Of them, Janne Koivukoski, Päivi Mäkelä and Nina Söderholm in particular contributed greatly, providing commentary on the different phases of the project. We also wish to thank the Ministry of the Interior for the funding and steering of the project.

Tampere, 14 February 2025

Mikko Räkköläinen

Contents

1 Abbreviations and terms

CIMIC	Civil-Military Cooperation .
EOD	Explosive ordinance disposal
hromada	A basic unit of administrative division in Ukraine, similar to a municipality. There are 1,469 hromadas in the country.
cargo ammunition	Ammunition that opens and scatters smaller cluster munitions or scatterable mines to a target area.
MSB	Swedish Civil Contingencies Agency (Myndigheten för samhällsskydd och beredskap)
oblast	A primary administrative division in Ukraine with an elected administration. There are 27 oblasts in Ukraine, including the Autonomous Republic of Crimea and the cities of Kiev and Sevastopol, which have a constitutionally guaranteed special status.
raion	Second-level administrative division in Ukraine. There are a total of 136 raions in the country, 3-8 in each oblast.
SESU	State Emergency Service of Ukraine (Deržavna služba Ukrajiny z nadzvytšainyh' sytuatsi, DSNS)
scatterable mine	A mine that is scattered randomly on the land surface in terrain. Scatterable mines can be deployed with different types of cargo ammunition or dropped directly from aeroplanes and helicopters.
Ukrzaliznyts	Ukrainian State Railway responsible for both operation and maintenance of the rail network
UXO	UneXploded Ordinance

2 Introduction

The war of aggression launched by Russia against Ukraine in 2022 is the first time in decades that a modern European society has experienced a full-scale, conventional interstate war. The war has underlined the need to maintain and develop Finland's national and societal resilience. It also offers an exceptional opportunity to collect information and to further develop our own preparedness for possible future conflicts.

Based on these starting points, the Ministry of the Interior's Department for Rescue Services commissioned the Emergency Services Academy to carry out a research project, the results of which are presented in this report. The objective set for the Lessons from Ukraine project was to answer four questions:

1. How has civil defence been organised during the war in Ukraine?

2. What has been the impact of the war in Ukraine on the civilian population and critical infrastructure?

3. How do the effects of the war in Ukraine differ in different population groups?

4. How are the lessons learned from the war in Ukraine applicable to the organisation and development of civil defence in Finland?

The questions have been answered by compiling extensive research data from document material collected from open sources and from interviews with various authorities and experts. The compilation of data was done following the definition of civil defence in international law (82/1980, Article 61). After this, the findings collected from the material have been grouped thematically to answer questions 1–3. Based on the findings, a number of recommendations were produced regarding the application of the lessons from Ukrainian in the development of civil defence in Finland, which answers question 4 set for the project.

Due to the increasingly volatile international security situation, several different projects have worked on situational awareness, instructions, and development work related to civil defence in recent years. The Lessons from Ukraine project has benefited from cooperation with these projects and their results. Of these projects, we'd like to mention the Civil defence shelter study's recommendations project, conducted by Janne Koivukoski, PhD, at the Emergency Services College in 2024. The final report of the Ministry of Interior project "Väestönsuojien nykytila Suomessa" (Pasi and Häyrinen 2023) authored by Project Manager Ira Pasi and Rescue Chief Inspector Jarkko Häyrinen was a very useful starting point for this project. Pasi's current project, Self-preparedness for emergency conditions, has also been a partner to the Lessons from Ukraine project. The "National operating model and training path for urban search and rescue" project currently under the direction of Planning Officer Nina Pulli and the TOKEVA 2024 programme implemented by Project Manager Jouni Salminen for the prevention of chemical accidents are closely linked to Lessons from Ukraine.

Useful research on Ukrainian civil protection activities during the current conflict has also been carried out elsewhere in Europe. Publications produced by the Swedish Civil Contingencies Agency

MSB (MSB 2023a, 2023b) should be mentioned as an example of this. These are part of the materials of the Lessons from Ukraine Project. MSB has also provided other assistance in the implementation of the project.

2.1 Materials and methods

The implementation of the Lessons from Ukraine project was divided into three phases: data collection, analysis, and the production of recommendations. The material was compiled in spring and summer 2024. It contains two parts: expert interviews and document materials. The definition of civil defence of the Geneva Convention (82/1980, Article 61) and the broad definition of critical infrastructure (Finnish Terminology Center 2017, 32) were used as a guide for data collection.

A total of eight expert interviews were conducted. The interviewed experts were Finnish civil servants familiar with the situation in Ukraine (5), representatives of the commercial sector closely familiar with the situation in Ukraine (2) and a person present in Ukraine at the beginning of the war (1 person). The interviews were conducted as semi-structured thematic interviews, in which a certain list of questions was presented to those interviewed, but the interviewer and the interviewee also discussed issues outside the list. This form of interview supports a very exploratory approach by allowing the people interviewed to bring up information based on their own expertise. At the end of the project, comments on selected recommendations were also collected from a number of Finnish experts.

All interviews were given anonymously. For this reason, they are not referenced in this report in accordance with normal citation practice, but instead the text contains information about the source of the material considered appropriate in each context. This usually includes the number of persons interviewed who gave consistent statements on the matter in question and, on a case-by-case basis, information on the nationality of the persons interviewed and the sector in which they work.

Document sources were collected from open sources by searching for relevant search terms in scientific databases, publication lists of different research institutes and on the open internet. In addition, the Ministry of the Interior offered its help in obtaining relevant documents from Ukraine and Finland's key partners in the support of Ukraine. In this context, some regulatory, report and research material related to civil defence in Finland was also collected. A total of 105 relevant documents were collected. Document material is referred according to normal scientific practice with internal references using the Harvard referencing style. A list of document sources can be found at the end of the report.

In the planning stages of the project, the aim was also to collect interview material from SESU representatives. An effort was made to organise interviews throughout the summer and autumn of 2024, but these proved to be impossible to carry out due to the understandably high workload of SESU, changes in security and access regulations during the process and interpretation issues . Instead of interviews, a short survey was submitted to SESU, to which Ukrainian experts could respond anonymously in their mother tongue. Unfortunately, due to delays in translations, this material could not ultimately be used in the analysis. Even so, SESU has provided very valuable assistance to the project in other ways.

The analysis of document and interview materials was carried out in parallel with its collection. The analysis was carried out in accordance with exploratory approach as thematic content analysis. The material was reviewed and all findings and recommendations possibly relevant to the project were collected and combined. All findings related to the same theme were grouped together to produce a coherent overall presentation. In this way, 13 themes and 316 findings were formed.

The objectives set for the project did not determine the depth of the examination. The exploratory approach does not in itself guide the examination to a certain level. As the data contained useful information from all levels of examination for Finnish civil defence and critical infrastructure security, the final results of the project also contain findings and recommendations from micro-level technical solutions to the macro level issues, such as legislation.

The project answers Question 4 ("*How are the lessons learned from the war in Ukraine applicable to the organisation and development of civil defence in Finland?*") by presenting a number of recommendations for the development of civil defence and the protection of critical infrastructure in Finland. The recommendations are listed in Chapter 4 of this report. The recommendations were produced by reflecting on themes and measures that proved important or useful in Ukraine to Finland's conditions. In addition, recommendations were presented directly in both document and interview materials. Those considered suitable for Finland from these proposals have also been included in this report.

A number of ways in which the conditions in Ukraine differ significantly from those in Finland were also highlighted while the material was analysed. As these findings also have value in answering question 4, they are presented in Chapter 4.1.

2.2 Restrictions and limitations

Due to the framing of the Lessons from Ukraine project and the limitations encountered in its planning and implementation, we will briefly describe what this report aims to achieve and what has been excluded. In addition, it is important for the reader to recognise the limitations of the project in order to be able to approach its results critically.

An exploratory approach has been the key starting point for the project. In other words, the project has not beenaimed at verifying, evaluating or describing a specific limited issue, but rather at mapping the given theme as extensively as possible. An effort has been made to achieve this primarily with extensive data compiled from many sources. Nevertheless, it must be stressed that this report is not an exhaustive presentation on civil defence in Ukraine. At the same time, the collection of material was concluded only when the review of the additional public material no longer seemed to produce new information. It is therefore reasonable to conclude that the presentation produced by the project is a comprehensive description of its subject. It is justified to argue that a more in-depth study would require the collection of data directly from Ukraine and the utilisation of confidential data.

The project proposal limited the examination to civil defence, critical infrastructure and the impacts of warfare on the population. It should be noted that mental resilience, economic resilience, broader efforts to guarantee the continuity of society, as well as issues of military defence, are largely excluded to the extent that they have no direct link to civil defence and critical infrastructure.

Question 3 of the Lessons from Ukraine project ("*How do the effects of the war in Ukraine differ in different population groups?*") could only answered to a limited extent on the basis of the material. It has not been possible to carry out an extensive statistical analysis within the scope of this project. In addition, no research-based answer to the question could be found in the document material. The documents and interviews have provided some information related to this theme, but these have been observations and assessments by individuals. However, the information corresponds to a general picture of which population groups are known to be the most vulnerable in conflicts.

The project material may contain sources of error. This should be recognized, although efforts have been made to minimise the possibility of errors by means of data collection planning. The main potential source of error is sampling bias. This may arise, for example, because the persons interviewed for the project are a group with a fairly uniform background that, due to education and experience, notices the same issues and analyses them using similar assumptions. Document sources that are partly selected according to their availability and accessibility likely also contain uniform starting points.

In addition, sampling bias may be caused by the inbred nature of the data. The majority of Finnish experts interviewed appear to have received information on civil defence in Ukraine from the same sources. The reports and studies utilised in the project are also partly based on the same original sources.

Efforts have been made to ensure the verasity of the results by collecting data as extensively as possible to avoid distortions caused by the sampling bias. The project utilises numerous studies and reports, which are based on independently collected data. The correct formation of the interview material has also been guided by planning the structure of the interviews and with the wording of questions. Based on these starting points, it can be argued that the composition of the data has not resulted in a significant bias in the project's findings and recommendations.

The third possible source of error related to the project material is Ukraine's strong communication policy. As a country at war, Ukraine has communicated very uniformly, and certain trends can be observed as a result, such as presenting its own military situation in a good light and highlighting violations of international law related to Russia's manner of warfare. Although this is, as such, understandable, during the collection and analysis of the data, Ukrainian sources have been approached with an awareness of such communicational tendencies. These have also been taken into account during the analysis of the data.

Finally, it should be stated that the Lessons from Ukraine project focused, as its name suggests, on mapping the situation in Ukraine. Due to the projects framework, limited resources and the classified nature of information related to preparedness, the domestic status of issues highlighted by the study has been mapped only summarily. For this reason, the recommendations produced by the project do not comment on the current state of civil defence in Finland. The recommendations are therefore only lessons from Ukraine. This report does not answer questions about which lessons are most relevant or necessary for Finland. However, they provide one additional set of tools with which authorities can reflect on their activities, identify potential areas for development or confirm the validity of existing practices.

3 Key findings

This chapter answers the first three questions set for this project:

1. *How has civil defence been organised during the war in Ukraine?*
2. *What has been the impact of the war in Ukraine on the civilian population and critical infrastructure?*
3. *How do the effects of the war in Ukraine differ in different population groups?*

The findings have been arranged according to the themes that emerged during the review of the material.

3.1 Evacuations

This section presents the findings related to the evacuation of the population due to the direct and indirect effects of military action both to locations in Ukraine and abroad. Using Finnish terminology, it covers voluntary and independent evacuation, protective evacuation and mandatory evacuation.

3.1.1 Evacuated and internally displaced persons

At the beginning of the period under review, due to the illegal occupation of Crimea and Eastern Ukraine, there were 1.46 million internally displaced persons in Ukraine. Most of them originated from the regions of Donetsk and Luhansk in eastern Ukraine. As the conflict had been ongoing in these areas since 2014, internally displaced persons were relatively well integrated in their new places of residence. (Channell-Justice 2021.)

Since the beginning of Russia's full-scale war of aggression, 6.9 million people have fled abroad from Ukraine. This is approximately 15% of the Ukrainian population. Half of these people left the country immediately after the war broke out in February-March 2022. The majority of those who left the country are women and children, which is largely due to the ban on international travel for men aged 18 to 60 that entered into force on 24 February 2022. (UNHCR 2024a.)

There are currently around 3.7 million internally displaced persons in Ukraine. 40% of them have had to evacuate more than once and 80% have been displaced for more than a year. The majority of internally displaced persons were originally residents of the area in the immediate vicinity of the front and are now in the oblasts of Harkova and Dnipropetrovska, which means that they have not moved very far from their former homes. Half of Ukraine's internally displaced persons have been displaced from cities or their suburbs. 25% of them were children and 22% were pensioners. In 53% of internally displaced households there is at least one member suffering from a chronic illness or disability, although it is not possible to say how this relates to the demographic situation prior to the war. (UNHCR 2024a.)

3.1.2 Implementation of evacuations at the beginning of the war

Several interviewed sources consistently estimated that, at the start of Russia's full-scale war of aggression, the Ukrainian government and authorities failed in organising evacuations. According to interview data, at the beginning of the war, people evacuated independently and voluntarily, without any guidance from the authorities to do so. According to the interviewees, this at some level surprised the Ukrainian authorities. Each municipality was required to have an evacuation plan, but several interviewees believed that not enough training related to these plans had been completed and nor had training been sufficiently concrete. At the beginning of the conflict, the high level agencies also did not provide sufficient instructions to local actors.

According to the interviewees, political decisions on evacuation could not be made early enough in Ukraine. As one of the experts interviewed said, an evacuation decision under threat of armed conflict is a very difficult political decision with negative economic and political consequences. Unlike natural disasters, hostile actors can also adapt their activities to evacuation orders and, for example, delay their own attack in order to create mistrust of decision-makers in the target country.

As official instructions on evacuations had not been disseminated to the population at the beginning of the Russian invasion, an interviewed source indicates that civilians sought help and advice from local authorities, such as fire stations. The fire brigades therefore had to take on new tasks, including the purchase and distribution of food and other essential supplies (see section 6.3.1). These activities also resulted in the creation of the points of invincibility (see section 3.9.1).

According to numerous interviewees, the local rescue authorities played an important role in organising evacuations in areas occupied by Russian forces. This was apparently largely unplanned and based on the initiative of individual local authorities. Sometimes placing themselves in considerable personal danger, officers of local rescue departments agreed on local ceasefires and secure evacuation routes with the representatives of the occupying forces. Representatives of rescue departments also acquired buses and other vehicles for the transportation of civilians. According to the official guidelines developed later, evacuations are carried out as convoys that meet in a certain place in the occupied area and run as a single group along the agreed route across the front line. Convoys are formed around buses carrying people who do not have cars, but they also include those travelling with their own vehicles. According to an interviewed source, organizations such as retirement homes and care facilities usually had their own buses or similar transport equipment at their disposal to evacuate residents. (Center for Strategic Communications and Information Security, no date, 51–55.)

According to an official Finnish source, at government level the Deputy Prime Minister of Ukraine was responsible for evacuations. Local military administrations are responsible for evacuations in the field, and they operate above local civilian administrations. The Ukrainian army's CIMIC teams have coordinated the planning and execution of evacuations with military administrations, local governments, military units operating in the region and SESU (CIVIC 2023, 13).

The convoys coordinated with the Russian armed forces were an important measure after the failure of the early evacuation. In numerous cases, the Russian armed forces fired at civilian vehicles when people tried to leave an area independently. Evacuating while Russian troops were advancing or had already taken over the territory seems to have been the most dangerous solution for Ukrainian civilians. As such, there is no reason to assume that the Russians have acted systematically, but more

so this was the result of poor military discipline and revenge due to Ukraine's (from Russia's perspective) surprising resistance which also resulted in more systematic war crimes, especially on the route of the northern attacking column. (OHCHR 2024a; Rudenko 2023, 85.)

In areas where Russian armed forces took longer to advance, the Ukrainian civilian population had more time to evacuate independently. This seems to have largely taken place by car, which caused, for example, traffic jams on Kiev's exit roads (Rudenko 2023, 27). The Ukrainian State Railway Company started offering free transport to the evacuating population heading to the western parts of the country (Aebi et al. 2024, 24). The free-of-charge evacuation trains had not been planned in advance, but the state-owned railway company Ukrzaliznytsja reacted spontaneously as the situation developed. According to one of the interviewed persons, people living in rural areas, who did not have a vehicle at their disposal, had difficulties reaching railway stations and other evacuation points.

3.1.3 Support of the evacuated population

According to the interviewed and documentary sources, the support and assistance of the population evacuated at the beginning of the war remained, in practice, the responsibility of the local administrations of the receiving municipalities (Brovko 2024, 11). As a large portion of the population evacuated at the beginning of the war, meeting their basic needs required considerable resources. Many non-governmental organisations, regardless of their previous sector, also started assisting internally displaced persons at the beginning of the war (Iatsyna and Zawadzki 2023, 59-61).

In the early stages of the war, internally displaced persons were accommodated through various temporary arrangements, such as camps with tents and sports hall accommodation. Those internally displaced persons who had financial capacity searched for housing independently. According to one interviewee, rents in Eastern Ukraine have therefore risen fivefold compared to the pre-war period. Low-income and otherwise vulnerable internally displaced persons have remained in temporary accommodation for months and even years. Organisations under the UN also report that the service provision in these camps is not adequate. The interviewed persons estimated that especially those with limited means, children and persons with disabilities suffer in these circumstances. (OCHA 2023a, 15; UNHCR 2024b.)

According to the information provided by SESU, during the war the authorities have created a harmonised digital database of internally displaced persons and accommodations offered to them. For this reason, the placement of internally displaced persons is now easier than at the beginning of the war, although their numbers have also been significantly lower since the end of more mobile warfare at the beginning of the war.

3.1.4 Consequences of evacuations

The major evacuations that took place in the early months of the war caused problems for numerous basic services and infrastructure. For example, in Western Ukraine, the capacity of mobile phone networks and the electrical grid were tested due to an increased number of people. On the other hand, consumption of electricity fell substantially in eastern and southern Ukraine due to the

shutdown of industrial activities and the evacuation of the population. This had consequences for the finances of energy companies, which further affected their ability to maintain and repair their networks (Aebi et al. 2024, 29; Piddubnyi and Goriunov 2024, 22–23). The migration of the population from cities to rural areas and the western parts of Ukraine has also required changes in the telecommunications network architecture and the construction of new cell towers (ITU 2022, 39). One of the persons interviewed also pointed out that the early stages of the war provided evidence that if power outages continued in cities for several days, residents will begin to evacuate independently.

Internal displacement has also affected health care in Ukraine. Areas close to the frontline suffer from a decline in the capacity in civil health care after doctors and nurses evacuate from the area. On the other hand, the healthcare system in the western parts of the country has had to deal with a larger population than usual. The healthcare is in the poorest state in the Russian-occupied territories, where the remaining population has considerable difficulties in obtaining even basic medication (PHR 2023, 16-19). The chaos caused by internal displacement and the economic and social vulnerability of refugees have also increased the risk of the exploitation and trafficking of disadvantaged people, especially children and young persons (OCHA 2023a, 81-82; Kowalkowsi et al. 2023, 15).

In addition to the scope and speed of voluntary and independent evacuation, the Ukrainian authorities have also been surprised by the number of people of have refused to evacuate. According to one interviewed person, 20% of the original residents may still remain in cities whose control has changed over several times during the war. According to those interviewed, especially in eastern Ukraine the refusal to evacuate may be motivated by indifference of being left on the Russian side of the border. Other potential reasons include a lack of resources, a desire to look after one’s immovable property such as buildings and farmland, and simply a reluctance to abandon one’s home. However, no detailed research has been found on the topic. The significance of the problem is indicated by the fact that a legislative amendment has been implemented in Ukraine that enables authorities to forcibly evacuate minors (Visit Ukraine 2023).

The war has also caused the evacuation of population in areas that have not been directly threatened by the fighting. Especially in winter, the residents of Kiev and other large cities have been urged where possible to move to rural areas to properties with wood heating and their own well (Jasinski 2023, 50).

3.2 Administrative arrangements

This section presents the findings on civil defence administration that emerged from the material. The three key themes of these findings were the overall structure of the Ukrainian regional administration and its impacts on civil defence, administrative issues related to humanitarian mine action, as well as the digitalisation of the Ukrainian administration and the utilisation of this digitalisation in civil defence.

3.2.1 Regional division of administration

Administrative reforms carried out in Ukraine after 2014 have decentralised power to regional and local administrations. Documentary sources estimate that this has been beneficial in war conditions, as it has enabled more flexible and faster decision-making. Despite the reforms, the Ukrainian system of governance remains among the most centralised in Europe (Brovko 2024, 2; Darkovich et al. 2023).

During a state of war, the regulations concerning local and regional government procurement and recruitment have been lightened. The bodies implementing policy at the Hromada (municipal) level have been authorised to make decisions in budgetary matters without prior consultation with the municipal council. Different levels of administration have been exempted from the requirement to tender procurements and implement comprehensive application processes for filling jobs. Direct procurements and recruitments allow for faster and more flexible responses to needs arising from the conflict. Such needs include, in particular, assistance for internally displace persons and residents who have otherwise suffered from the war, and the recruitment of substitutes to replace workers who have fled due to the war (Brovko 2024, 9-10).

Due to the war in eastern Ukraine, regional military administrations have been operating in some areas of Ukraine since 2014. When Ukraine moved to a nationwide state of war due to Russia's full-scale invasion, military administrations were also extended to all of the country's oblasts. Regional civilian administrations are subordinate to military administrations. If, due to the consequences of the conflict, civilian administrations are unable to carry out the tasks assigned to them, military administrations take over the tasks directly and replace hromada administrations (Brovko 2024, 12).

Ukraine's State Emery Service (SESU) is a national body. This has enabled flexible mobility of resources within the country as needed (see section 3.6.6). According to an interviewed expert, certain special capabilities, such as CBRNE specialised units, are also managed through a national center.

3.2.2 Administration related to clearing

Humanitarian demining and related administrative issues were prominent in the project materials. Demining has proved to be a major challenge, as the Russian armed forces have heavily mined the areas they occupy. In addition, areas in the possession of Ukraine have been polluted with scatterable mines and cluster bombs. Ukraine has also begun to use landmines in its defensive efforts, contrary to its international treaty commitments. This increases the need for clearing as the front lines move. Explosive items pose a danger to civilians, hinder the repair of infrastructure and other damaged sites, and hamper business activities, e.g. making fields unfit for cultivation (Mine Action Review 2023a, 2023b).

Until the end of 2022, there were three different authorities involved in clearing operations in Ukraine: the National Mine Action Center under the Ministry of Defence, the Humanitarian Demining Center under SESU, and the intra-ministry National Mine Action Authority. In spring 2023, an inter-ministerial committee on humanitarian demining was formed above these. Based on document sources this administrative structure was found to be confusing and somewhat overlapping. (Mine Action Review 2023a, 364.)

Ukraine has not been able to form a comprehensive mine action strategy. Such a strategy would define the command structure for clearing of mines and the related responsibilities and prioritise different types of clearance sites. Instead of a comprehensive strategy, the Ukrainian Ministry of Defence has produced annual lists of sites requiring mapping and clearing in cooperation with local administration. The Ukrainian authorities have referred to the challenges posed by the state of war as the reason for the lack of a national strategy. (Mine Action Network 2023a, 370.)

There are around 30 humanitarian mine clearance organisations operating in Ukraine. International actors, such as the HALO Trust and the Danish Refugee Council, have struggled to obtain the licences necessary for their activities from the Ukrainian authorities during the war. In addition to general licences, the complex administrative structure described above and poorly implemented legislation have made it more difficult to obtain the special permits needed to transport and destroy explosive items. There have also been problems with the import permits for the necessary equipment, as a majority of these are considered dual-use items (Mine Action Network 2023a, 365).

Ukraine has in place an IMSA Core mapping database for mapping areas polluted by explosives and for mapping their clearance. The system receives daily data from different demining organisations. Authorities validate the data after which it is made partly available to the public. As Ukraine does not have a comprehensive clearance strategy, it also does not have a specific plan for taking the gender perspective into account in clearance. However, individual international organisations have implemented their own gender sensitivity strategies. These are reported to produce useful additional information on both mine victims and the most important demining areas for local communities. (Mine Action Review 2023a, 368–369.)

3.2.3 Digitalisation of administration

In 2020, the Ukrainian state introduced the digital Diia e-service. Citizens can use the service's own application and website to use the services of more than 130 state institutions. The application also provides electronic copies of numerous official documents of citizens. The service has generally been considered successful, although there have been some problems with its use. The most notable of these is the leaking of over 26 million driving licences from the service, apparently as a result of an attack by hackers linked to Russia (ITU 2022, 22-23).

The possibility of using copies of electronic official documents through the Diia service has proved important during the war. Many evacuees have lost physical copies of their personal documents. New functionalities have also been added to the service since the beginning of the war. For example, it allows residents to register as internally displaced persons. The possibility for registering ones data in a centralised national database is also utilised, for example, in reuniting family members who have been separated due to the conflict. The service is also used for registering facilities suitable as shelters and for informing the public on them (ITU 2022, 23; MSB 2023b, 17; SESU 2023, 16).

Numerous document sources have emphasised the importance of information security measures in Ukraine. Numerous private operators in the sector began to increase their level of preparedness a few months before the Russian invasion. The most important of the measures in this respect was the decision to transfer data critical to the operation of the state administration to foreign servers shortly before the Russian invasion. In this way, government data has been safe from Russian

physical strikes and cyberattacks. To this end, Ukraine has made use of the cloud services of the most important global players in the sector, such as Google and Amazon, which it was allowed to use at a discount or even free of charge. (Aebi et al. 2024, 28.)

3.3 Critical infrastructure

Different types of attacks on critical infrastructure have been a central part of Russia's strategy (see section 3.8.1). Cyberattacks and physical attacks have targeted logistics, telecommunications and the production and distribution of fuel, heat, water and electricity. Many of the persons interviewed estimated that, with the possible exception of psychological traumas, the consequences of attacks on infrastructure have been the most significant way in which the conflict has affected the civilian population in Ukraine. Especially in winter, problems with the production and distribution of heat have been a significant problem for civil defence. The interviewed persons emphasised the importance of backup power solutions.

This section presents key findings on critical infrastructure by sector. The findings made in the material concern telecommunications, energy infrastructure, heat and water distribution, logistics, the impacts of infrastructure attacks on civil defence and measures aimed at protecting critical infrastructure in Ukraine.

3.3.1 Telecommunications

The Russian armed forces have targeted Ukraine's telecommunication connections with both physical attacks and cyberattacks throughout the war. For example, at the beginning of the war, Russia managed to attack the Viasat KA-SAT modems, which were widely used in Ukraine, which affected the telecommunications connections of both the armed forces and civilian actors. Cyberattacks were also carried out on the networks of individual service providers. In the summer of 2022, approximately one fifth of Ukraine's mobile phone network capacity had been lost, at worst in November 59%. In addition, telecommunications connections have been severely affected by attacks on electricity production and distribution (Aebi et al. 2024, 27; Kukkola 2024, 58–59). This has had further consequences. For example, according to the interviewee who was in Ukraine, civilians experienced difficulties during the early stages of the war in purchasing food because their debit cards did not work due to electrical and telecommunication connection problems.

After succeeding in taking over the wireless and fixed telecommunications infrastructure, Russia rerouted Ukrainian data traffic through servers located in Russian territory. This made it possible to monitor, redirect or block traffic. Russia also disrupted television and radio broadcasts with electronic warfare and bombed more than 30 television and radio masts during the first month of the war (Aebi et al. 2024, 27).

Both authorities and commercial service providers have taken a number of measures to improve the resilience of telecommunications. More frequency bands were made available to service providers through legislative amendments. According to an interviewed Finnish expert, during the conflict 5G networks have demonstrated their technical resilience, which is based on a dense network of cell stations. The three major mobile subscription providers in Ukraine concluded a mutual agreement in spring 2022 on the provision of internal roaming services to their customers. In this way, the

consequences of any disruptions to one service provider can be minimised by automatically transferring telecommunications traffic to another provider's network (Aebi et al. 2024, 31; Schroeder and Dack 2023, 15). According to the interviewed Finns who had visited Ukraine, local authorities use mobile phones and especially their messaging applications, such as Whatsapp and Signal, for their work-related communications.

Key measures taken by commercial service providers have included ensuring electricity supply to transmission towers during disruptions. Based on the interviews, this has been done by adding backup power systems - usually diesel generators - and replacing old lead-acid batteries in transmission towers with higher capacity lithium batteries. Some telecommunications companies also took action to destroy the physical and software infrastructure of information networks in the areas where Russian troops were advancing at the start of the war. The aim was to protect the networks from the enemy's activities and to deny the enemy the ability to utilise the infrastructure for their own needs (Aebi et al. 2024, 28–29).

SpaceX's satellite-based Starlink internet connection has been one of the most prominent technological solutions for telecommunications infrastructure disruptions. The necessary terminal equipment has been donated to Ukraine by both the company and Ukraine's partner countries. Although the satellite-based connection is not as fast as a wireless or fiber-optic connection, Starlink terminals equipped with batteries have served as an efficient backup solution for both military and civilian use during service interruptions. There have been no reports on Russia being able to interfere with their signal. However, some state actors have not switched to satellite connections because these can be located. The strong dependence on one service provider has also led to numerous public disputes between the Ukrainian administration and Elon Musk, the founder of SpaceX. The disputes have concerned such things as how the operating costs of the system will be covered and the company's unilateral decision to restrict the operation of terminal equipment delivered to Ukraine to a specific geographical area (Aebi et al. 2024, 28; Schroeder and Dack 2023, 16–18).

3.3.2 Energy infrastructure

The Russian armed forces have targeted the Ukrainian energy infrastructure throughout the war. During different stages of the war, the air strikes have been distributed in different ways (see section 3.8.1). In October 2022, Russia launched a massive series of strikes on energy infrastructure sites. It is believed that its objective (Aebi et al. 2024, 8; Rimutis 2024, 3) was to first bring down the Ukrainian energy sector over the winter, and then the will of the Ukrainian people to resist the aggressor. In winter 2023-24, strikes on energy infrastructure were not particularly strong, but they have accelerated again in 2024.

Russia's missile and drone strikes on Ukrainian electricity infrastructure have occasionally led to extensive power outages affecting millions of residents. Although the strikes have targeted both production plants and the transmission network, most of the outages have been due to the inability to transfer produced electricity to consumers (Rimutis 2024, 7; Watling and Dolzikova 2024).

At the start of the war, more than half of Ukraine's energy production was based on nuclear power. Most of this capacity was lost as Russian troops occupied the Zaporižja nuclear power plant in March

2022. Although Russia has not directed military strikes on nuclear power plants, it has targeted the transformers of power lines that serve nuclear power plants. Due to these strikes, reactors at Zaporižja and other Ukrainian nuclear power stations have repeatedly had to be shut down (Watling and Dolzikova 2024).

Russia launched its war of aggression on Ukraine just as Ukraine was conducting a trial in which its electricity grid was disconnected from Russia's grid and synchronised with the European ENTSO-E network. There has been no way to verify the connection between the beginning of the war and the electricity network trial. It is possible that Russia hoped to use the disruptions that might result from the trial to increase confusion in Ukraine. However, the trial was successful and, as a result of the war, it was quickly turned into a permanent solution. The new arrangement has given Ukraine more freedom to manage its own electricity network and, correspondingly, denied Russia the opportunity to monitor the state of Ukraine's network (Aebi et al. 2024, 10; Rimutis 2024, 8).

Despite extensive power outages, the Ukrainian electricity network has been protected by its overall architecture, which was created in the 1980s during the Soviet Union. The network is designed so that it can be divided into five "islands" that can operate independently until the integrity of the national network has been restored. In addition, before the war, the transmission capacity of the Ukrainian network was approximately 56 GW, even though its production was only 32 GW even in optimal conditions. Due to the damage resulting from the war, both production and transmission capacity is currently estimated at 10-15 GW. The Ukrainian network's connections to other countries are also relatively limited. There have been strikes on cross-border transmission lines, and there are no significant energy reserves in the areas near Ukraine that it could use during wintertime (Watling and Dolzikova 2024.)

Despite the safeguards, Ukraine has also had to take into account the possibility of the entire network crashing as a result of physical attacks targeting it. In such a situation, many power plants would automatically shut down as a safety measure. In this case, restarting the network could prove to be a very complex operation, especially as damage to the electricity network would have to be repaired simultaneously. An extended interruption may also continue to cause new challenges, such as the depletion of the backup batteries for communications needed for the start-up, the temporary incapacitation of nuclear power plants due to neutron poisoning of reactors and damage resulting from the cooling of the district heating system in winter. (Nikolaieva and Zwijnenburg 2022; Popik 2022, 41–42.)

At the start of the war, Ukraine did not have sufficient equipment and spare parts to repair the energy infrastructure. Due to high consumption, the situation has not improved despite foreign aid. In particular, there has been a continuous shortage of transformers (MSB 2024a, 22). The substantial drop in industrial consumption resulting from the war, the regional shift in electricity consumption due to evacuations, and the price regulation introduced due to the war have caused major economic problems for companies in the sector that have been apparent in their performance (Piddubnyi and Goriunov 2024, 22).

Ukraine has taken legislative action to maintain the capacity to repair energy infrastructure. In 2022, personnel serving in repair tasks in the energy sector were exempt from military service. In January 2023, products intended for the repair of energy infrastructure were exempt from VAT (MSB 2023a, 20-21). However, repairing damage caused by war by building new infrastructure has led to a

situation where sufficient resources have not been available for the normal maintenance of the network and production facilities (Rimutis 2024).

3.3.3 Heat and water distribution

In addition to the electricity network, in the winter of 2022-2023 Russia targeted strikes at heat production plants. In Ukraine's large cities, the majority of buildings are served by the district heating network, so by hitting heat plants, Russia has been able to impact large numbers of civilians at once. During the first winter of the war, approximately 60% of Ukraine's heat production capacity was damaged. During the series of missile and drone strikes in summer 2024, up to 80%-90% of heat production capacity was lost. The civilian population has reacted to the lack of district heating by moving to dwellings heated by other means or by organising alternative heating methods for their urban dwellings (Aebi et al. 2024, 12; Matuszak and Jedrysiak 2024).

The water supply in Ukrainian cities has suffered the consequences of extensive power outages. Missile strikes have also caused extensive leaks in the pipelines. It should be noted that explosions also damage underground infrastructure, such as sewers and water pipes (Jasinski 2023, 51).

3.3.4 Logistics

Especially in the early stages of the war, Russia focused its attacks on Ukraine's logistics networks with the apparent purpose of disrupting defence efforts and the transfer of troops. In the longer term, the goal seems to have been damaging the Ukrainian economy. In the summer of 2022, an estimated third of Ukraine's logistics infrastructure was damaged to some extent. Especially in the early stages of the war, road transport hubs were hit. Ukraine also had to strike these targets in the temporarily occupied areas in order to hamper the progress of Russian forces (Aebi et al. 2024, 10; MSB 2024a, 22).

Air traffic in Ukraine was suspended immediately at the start of the war and has yet to be restored. Strikes were targeted at the most important airports in Ukraine immediately at the beginning of the war of aggression. SESU has its own aircraft and helicopters, primarily for extinguishing forest fires and transporting patients. These planes have been dispersed to different fields (Aebi et al. 2024, 10; MSB 2024a, 22).

As is the case with the Ukrainian electricity network, the country's railway network originates from the Cold War era, and resilience during war has been taken into consideration in its architecture. The railway network consists of sections that have their own independent command centers and high-frequency communication system between these. This makes it possible to divide the railway network into independently functioning sections if necessary. In addition, the Ukrainian state railway company still has facilities in its organisation that produce spare parts for ordinary repair work. Railways do not seem to have been a particular priority for Russian attacks, possibly because the uniform track gauge allows Russian troops to use railways for easy mobility. In April, however, Russia carried out a series of strikes on stations and railway command centers. It has also hit the Dnestr river delta's bridges and the Beskydy railway tunnel with cruise missiles. The former are used for transporting exports from Ukraine to open Black Sea ports, while 60% of the country's exports to the EU travel through the latter (Aebi et al. 2024, 10; Popik 2022, 31–32).

Ukraine also has numerous large ports on coast of the Black Sea and shores of key inland waterways. In particular, seaports have been hit by long-range weapons, they have been mined, and the Russian navy began to blockade them before the official start of the war. Before the war, ports were an important channel for oil and coal imports, so the blockade has had a knock-on effect on the country's energy production. Similarly, agricultural products exported through ports were one of Ukraine's most important export articles. (Blank 2023, 88–89; Popik 2022, 32.)

3.3.5 Protection of critical infrastructure

As one of the persons interviewed for the project stated, it is more important for society to protect critical infrastructure than individuals, as infrastructure can help to protect large numbers of people. Numerous persons interviewed mentioned that electricity and fuel distribution disruptions affect all aspects of civil defence.

The key lesson of the war fought in Ukraine is that full protection of infrastructure is not possible in a modern conventional war in which the opponent has ample long-range weapons at their disposal. Therefore, the objective has been to increase the resilience of infrastructure. In Ukraine, this has been done with measures such as increasing the volume of spare parts stocks and number of repair personnel, a planned transfer of electricity production from large production plants to smaller, 50 MW gas-fired power plants, and by distributing these plants in a decentralised manner. In addition, the development of air defence which serves infrastructure and the layering of various interceptor systems will weaken the effectiveness of Russian attacks and increase their price. However, air defence alone is not enough to completely prevent them. This is why transformers and other vulnerable objects in the electricity network have also been protected with simple concrete barriers. Although barriers are unable to fully absorb the impact of the weapon effect, they reduce it, which means that either the damage will be lesser or Russia will have to use more resources to produce the same destructive power (Aebi et al. 2024, 11, Watling and Dolzikova 2024). From a resource perspective, concrete barriers are a cost-effective addition to the protection of critical sites.

Russia's response to energy infrastructure protection measures has been to strike the same targets several times. The time between strikes has ranged from hours to weeks. In the former case, the aim is probably to prevent rescue operations, the extinguishing of fires and the limitation of damage. Strikes over a longer period time may aim to prevent or interfere with plant repairs. In both cases, non-military personnel, rescuers or technicians may be subjected to double attacks.

As part of its warfare, Russia has interfered with GPS positioning signals by means of electronic warfare in Ukraine. This has had an impact on the Ukrainian electricity grid, as in addition to location information GPS provides a very accurate timing signal. Highly accurate time information is needed in the synchronisation and frequency repairs of the electricity grid. Simultaneous physical attacks on the grid have caused major problems in monitoring and maintaining the status of the grid. According to its own report, the U.S. technology company CISCO has supplied industrial grade ethernet switches to Ukraine. These switches can use their own internal clocks to time high-voltage network control devices with sufficient accuracy during short-term GPS interruptions (Marshall 2023).

3.4 Health care system

A health care system is one of society's critical functions. At the same time, its functional capacity is influenced a great deal by the operation of other infrastructure, such as electricity and water distribution. For example, military strikes on hospitals and the power grid simultaneously increase the requirements for resilience (see section 4.3.). This chapter describes risks to hospitals and their prevention, changes in healthcare demand caused by the war, and measures taken by the Russian armed forces in their occupied areas interfering with health care facilities.

3.4.1 Hospital preparedness measures

Russia's war of aggression has put Ukraine's health system under great pressure. Russia's attacks - contrary to international rules of armed conflict - have also targeted hospitals, ambulances and other health institutions such as pharmacies and blood banks. In 2022, a total of 86 attacks against health care personnel were documented. Strikes against health care were particularly common in the first months of the war, and regionally they usually took place close to the front line. The most common strikes have been different artillery and rocket artillery strikes, which Russia has directed to areas inhabited by civilians as part of combat activities (PHR 2023 10-14).

Based on the interviews, Ukrainian hospitals have created their own evacuation teams, whose task in the short term is to evacuate patients and personnel to bomb shelters and, in the long term, to safer hospitals. Efforts have been made to equip hospital bomb shelters so that patient care - and even surgery - is possible in them to a limited extent, although it is not known how extensively this has been achieved. Hospitals, nursing homes and similar institutions have their own evacuation plans and often also their own buses and similar vehicles, which can be used to carry out evacuations, at least to some extent.

Near the front line, hospitals have been destroyed in battles to the extent that they are no longer fit for use. As a result, civilians may have found themselves in a situation where the nearest healthcare institution is in the next city, which may be 50 kilometres away. An effort has been made to alleviate the problem in part by creating mobile clinics that serve cities during the repairs of the actual hospitals. Near the frontline, hospitals are also severely affected by a shortage of labour, as their staff has been able and willing to evacuate to a safer area or abroad (PHR 2024, 16; 34).

Disruptions in the supply of electricity to healthcare institutions, either directly as a result of military strikes or indirectly as a result of larger disruptions in the electricity network, have caused significant problems in Ukraine. Hospitals are generally equipped with diesel-powered generators. On the other hand, large quantities of raw materials and finished products have been lost throughout the production and distribution chain of medicines, due to cold chain disruptions caused by power outages (PHR 2024, 16).

As noted above, hospitals have most often been damaged by explosions of wide-area effect weapons near them. This usually breaks large a number of windows, which puts staff and especially patients at immediate risk, both due to glass shards and in winter due to cold conditions. Ukrainian hospitals have had to set up heat management teams who are tasked with moving patients to heated spaces, using different space heaters and performing temporary repairs to protect indoor spaces from weather conditions (PHR 2024, 47).

3.4.2 War-time requirements for healthcare

Warfare in general, as well as Russia's massive use of weapons with wide-area effects against civilian targets in particular, produce injuries that are different in nature from the cases encountered by the health care system during peacetime. Although the project does not have accurate statistical data, certain characteristics of war-time healthcare should be highlighted.

A characteristic of wartime health care is an increase in injuries requiring amputation. These are the direct result of the blast effects of weapons and the crushing injuries suffered by those on top of whom buildings have collapsed. In addition to immediate care, injuries of this type also require long-term rehabilitation and the production of prostheses and the teaching of their use. Rehabilitation in Ukraine is also supported by NGOs. According to an interviewed expert, patients with severe blast injuries are also commonly forwarded to international patient evacuation. (Lebedeva et al. 2023, 187; HOUP 2024.)

Based on the information collected during interviews, the training of emergency medical workers in the treatment of chemical injuries has increased in Ukraine. In particular, white phosphorus, which ignites by itself and also poses a risk to nursing staff, has proved to be a risk to healthcare. Explosion and the resulting fires also cause many severe burns.

As there has been a strong increase in humanitarian mine clearance, there are also be more accidents related to it. To support the activities, SESU has organised 40 medical teams from different sources (SESU 2022).

3.4.3 Russian actions towards healthcare workers and institutions

It has been reported that Russian troops have stolen ambulances and medical supplies from hospitals in the areas they occupy (PHR 2024, 39). The occupation authorities have also ordered Ukrainian doctors remaining in the occupied territories to register in Russian administrative registers and to continue their work in accordance with Russian regulations. Hospitals in Russian-occupied territories have had great difficulties in purchasing medicines and other supplies (PHR 2024, 45).

The Russian occupation authorities have also demanded access to the information systems of hospitals. Through personal data files, they have been able to identify and locate e.g. persons who previously served in combat in Eastern Ukraine, who have then been subjected to retaliatory measures, such as denial of medicines (PHR 2024, 45).

3.5 Cooperation between organisations

Civil defence, the protection of critical infrastructure and other activities related to these themes have required extensive cooperation both between different levels of administration and across administrative boundaries in Ukraine. Cooperation between civil and military authorities and the public, private and third sectors has also proved to be extremely important and also taken new forms. As the significance of the theme emerged very clearly in the material, it is covered in this report as a separate chapter. This chapter covers vertical and horizontal cooperation within the civil

administrations, as well as cooperation between authorities and the commercial sector, NGOs and volunteers.

3.5.1 Cooperation between different levels of civil administration

According to an analysis carried out by Brovko (2024, 13), cooperation between local and central administration in Ukraine was important in the early stages of the war, especially in terms of the delivery of humanitarian aid and the coordination and support of evacuations. However, there were many problems in coordination and provision of instructions between central and local administrations in the early stages of the war. Apparently, the central government was not sufficiently prepared for a full-scale war, despite the conflict that had continued in the eastern parts of the country since 2014. During the Russian war of aggression, coordination between different levels of Ukrainian government has improved considerably. The establishment of military administrations bodies in all oblasts and raions also somewhat improved the situation in the short term.

According to different sources, the activities of different levels of administration and responsible organisations as a whole were hampered at the beginning of the war by a lack of adequate preparedness planning. According to the persons interviewed, preparedness planning was not sufficiently concrete and detailed, and the implementation of the plans had not been practiced sufficiently. Despite warnings from various sources, no adequate preparedness measures were taken in the days immediately preceding the Russian invasion.

3.5.2 Cooperation between authorities

In wartime conditions, rescue departments under SESU have had to deepen their cooperation with the Ukrainian armed forces at the national, regional and local level (Tiutiunyk et al. 2023, 30). At the operational level this has meant, for example, coordination between fire departments and locally operating military units in order to identify the symbols to be affixed to rescue vehicles, the passwords to be used and similar methods to identify friendly units. Especially at the beginning of the war, Russian troops were reported to have used stolen emergency vehicles to be able to move more freely behind the Ukrainian lines. (Kalynovskoi and Kovalenko 2023, 150.)

According to an interviewed expert, due to the danger posed by military aircraft, the flying of drones used in fire and rescue operations must also be coordinated locally with the military authorities. The distribution of the information about air activity produced by the Ukrainian armed forces to the civilian authorities works well, as there were effective channels for exchanging information before the Russia’s war of aggression began.

Joint planning between civil defence authorities and other military and civilian authorities has proved necessary to minimise the impact of attacks on critical infrastructure. The Ukrainian army has formed Civil-Military Cooperation teams. These teams are intended to coordinate activities such as evacuations, the distribution of humanitarian aid and the protection and restoration of critical infrastructure between civilian and military administrations. The coordination also includes the Ukrainian National Guard, which is responsible for the internal security of the country. The CIMIC teams also produce a situational picture for military authorities (CIVIC 2023).

According to some reports, Ukrainian civilian authorities also support military authorities and the Ukrainian army within the resources and infrastructure at their disposal. This surprising, given the risk that civilian authorities supporting military activities may become legitimate targets of military action under international law. (Brovko 2024, 11.)

Based on the data collected during interviews, the Ukrainian army also supports the operational activities of SESU rescuers by clearing unexploded warheads and other munitions (UXOs) at long-range weapons hit sites. This observation is also surprising, as the presence of soldiers in rescue operations can make them legitimate targets for further attacks.

Based on an interview source, the Ukrainian fire and rescue services have also started documenting the damage and personal injuries caused by Russian attacks to civilian population and property. Documentation is produced for future war crimes trials. Such activities require cross-administrative cooperation with the rescue services, the police and the prosecutors.

3.5.3 Cooperation between the public and commercial sectors

Especially at the beginning of the war, when there was a delay in response times by the higher authorities, improvised cooperation between local authorities, companies and farmers became an important tool that safeguarded the continuity of basic services. For example, companies deposited cash with local banks to ensure their liquidity (Brovko 2024, 11-12) and the production and distribution of food to the population was carried out as a cooperative effort. In such cooperation, the authorities thus flexibly supported the resilience of society by extending their activities beyond their basic tasks. One interviewee said that one such example was a local rescue department organising deliveries of raw materials to a local bakery.

At a higher level, shortly after the outbreak of the war, the Ukrainian authorities formed coordination centers between relevant ministries and critical industries. Their objective was to promote cooperation between the public and private sectors. In addition, the authorities set up two security centers - one for the electricity grid and one for the oil industry - to organise and coordinate cyber defence (Aebi et al. 2024, 18).

The private sector has also played an important role in the organisation of civil defence shelters. Ukrainian legislation previously required large companies to provide civil defence shelters in the vicinity of their factories and other facilities for their staff and often also their families (SESU 2022). In 2022, legislation was reformed to require the construction of bomb shelters in new buildings, as in Finland (DBN B.2.2-5:2023).

3.5.4 Cooperation with NGOs

After the war began, many NGOs took various measures to help the civilian population and support civil defence. Many organisations that had not worked on issues of this kind during peace time also altered their activities to meet the needs of the exceptional circumstances. NGOs have played a particularly important role in organising the welfare, housing and transport of internally displaced people. Some points of invincibility are also operated by NGOs (see section 3.9.1). In addition, NGOs

have supported civil defence by, for example, mapping the level of equipment at civil defence shelters (Iatsyna and Zawadzki 2023).

A factor hampering cooperation between SESU and NGOs is that Ukrainian legislation is still not believed to be at the level required by the role of NGOs in wartime. This is largely due to the undeveloped civil society in Ukraine compared to countries such as Finland. Despite this, SESU has created an interim body to coordinate cooperation with NGOs (Iatsuna and Zawadzki 2023). In addition, the Ukrainian authorities have shared register data on citizens with NGOs to facilitate assistance (OCHA 2023a, 44).

3.5.5 Volunteering

Ukraine did not have a strong culture of volunteering before the war. However, based on the interviews, this has clearly changed due to an increase in national spirit brought on by the conflict. Individual volunteers have played an important role in tasks such as the establishment and maintenance of Points of Invincibility. Volunteers are also usually the first to arrive at the scene of Russian attacks, and they assist the authorities in rescue and clearing work.

The Ukrainian authorities have created a mobile phone application that allows citizens interested in volunteering to register and report their location and possible special skills. After this, they may then be asked, if necessary, to assist the authorities. Based on the interviews, more than 10,000 volunteering civilians have also been trained to work independently in various civil defence tasks. Their importance is particularly great in sparsely populated areas.

3.6 Rescue services

Rescue services are responsible for a number of key civil defence tasks. They are subordinate to the State Emergency Service of Ukraine (SESU). This chapter describes the change in the circumstances and tasks faced by the Ukrainian rescue services during the Russian war of aggression and the operational, strategic and resource-related means by which the rescue services have responded to these changes.

3.6.1 Change in tasks during the war

Russia’s war of aggression has dramatically changed the Ukrainian rescue services’ assignment profile in terms of content, quantity and regional distribution. The volume of the tasks has naturally increased dramatically. For example, in 2022, SESU received more than 75,000 military activity-related alerts, responded to 30 large fires at oil storage and production sites and 120 large fires at energy plants. Another change is that the assignments following military attacks on institutions of this kind are more challenging than assignments at the same locations in peacetime would usually be. For example, an attack on an oil plant can cause numerous simultaneous leaks and fires. The number of assignments within the country has varied considerably, focusing on the eastern parts and large cities. (Lisniak and Senchykhin 2023, 42; SESU 2022.)

During the first year of the war, SESU participated in the distribution of 7,600 tonnes of food and over 45,000 litres of water to the civilian population. The distribution of humanitarian aid, especially in areas from which occupying forces have recently been evicted, has become an important task. SESU staff have also been involved in urban search and rescue activities together with volunteers. SESU plays a role in organising evacuations together with other actors (see Chapter 3.2.1) and its staff participates in performing temporary damage control repairs following attacks on critical infrastructure (SESU 2022).

3.6.2 Changes to mission tactics

The emergency conditions and Russian military operations have created new types of operational constraints and dangers for Ukrainian rescue services to which they have had to respond with changes in mission tactics and planning.

First, a number of factors have led to an increase in assignment response times. The movement of emergency vehicles to the sites has slowed down, as especially after extensive strikes, there is often rubble of damaged buildings on the streets. Traffic lights also do not work during power outages. (Kalynovskyi and Kovalenko 2023, 149.)

In the site itself, the mission must be started by examining the area for scatterable mines, cluster bombs and unexploded munitions. If these are found, the assignment often has to be interrupted until a unit capable of clearing these can be brought in. In addition, evacuation routes and shelters for personnel and equipment must be mapped out. Due to the danger to rescuers, only a small unit is usually sent out for the survey work. (Kalynovskyi and Kovalenko 2023, 156–157.)

Second, the missions caused by military activities are dangerous and challenging. Building fires resulting from missile strikes spread exceptionally quickly, as explosions often break fire compartments. Strikes often target oil terminals and oil-rich electricity systems, where they cause more damage than accidents during peacetime and cause oil fires that are very difficult to control. Strikes on infrastructure, which cause extensive power outages and break water pipes, also complicate the supply of fire-extinguishing water. The Ukrainian rescue authorities have developed ways to chain pumps and tankers so that natural water can be sourced to fire sites from substantial distances. (Kalynovskyi and Kovalenko 2023, 151–156.)

The dangers of hypergolic chemicals used as fuel for Russian missiles have also been highlighted in the interview data. These substances are extremely toxic and use strong acids as oxidisers. Substances contaminate the targets and, as a result of the attacks, may also vaporise, making them difficult to detect and clean. According data received during interviews, an effort has therefore been made to purchase equipment suitable for chemical hazard assessment. (MSB 2023a, 28.)

According to interview data, double-tap strikes carried out by the Russian armed forces are considered a major risk. In these kinds of strikes, the same target is hit consecutively. A follow-up attack after a missile strike often involves a strike with a drone, in which case the attack can be targeted more accurately against either the rescuers or the most valuable parts of the target. The experts interviewed estimated that the primary purpose of the attacks is to generate additional damage and to prevent the damage from being limited. The killing of rescuers was not considered a

key objective of the activities in the interviews, although it naturally weakens civil defence and rescue services in Ukraine and thus serves Russia's objectives.

Due to the threat of double-tap strikes, each assignment has an air hazard observer who works with the Ukrainian armed forces to maintain a situational awareness and anticipate possible double-tap strikes (Lisniak and Senchykhin 2023, 50). Finland has delivered armoured containers to Ukraine, which serve as rest and break facilities for rescuers during long missionss. It is noteworthy that, in spite of the risk of double-tap strikes, Ukrainians have instructed that containers continue to be clearly and prominently marked as civil defence locations.

Due to the problems described above, SESU has had to carry out strong prioritisation and each assignment always has "minimum manning with maximum dispersion" as one interviewed person put it. The most important assignment is been to save survivors from the ruins. Especially in the case of large air strikes, targets that do not pose a danger to the population are often deprioritised and allowed to burn out instead of extinguishing them. The military value of the location also affects its prioritisation.

3.6.3 Rescue personnel

As the war increases the need for certain special capabilities (see Chapter 3.6.4), new kinds of requirements have also emerged for the skills of rescuers. The capability highlighted most prominently in the project's interview and documentary material is urban search and rescue. SESU has experienced a shortage of labour with the skills for stabilising ruins, checking them for explosives and toxic residues and safe removal of survivors. In war conditions, there has also been a great deal of demand for skills such as working in elevated areas, i.e. stabilizing and moving within damaged blocks of flats (Lisniak and Senchykhin 2023; MSB 2023a). According to as interviewed source, rescue services have also increased first aid training aimed at giving immediately lifesaving aid.

Due to the conflict in eastern Ukraine that has been ongoing from 2014, SESU had invested in mine identification training, and based on the interview data, every fire department had at least one person trained in identifying different mines, at least in principle. On the other hand, fewer teams were trained in clearing. They were meant to respond based on observations made by local fire departments, but in practice in the early stages of the war, the clearing teams had great difficulties in getting to sites.

Especially at the beginning of the war, there were serious shortcomings in the personal equipment of rescuers. Personal protective vests and military helmets were not available. Based on the interviews, the lack of protective equipment caused significant personnel losses. The situation has improved and current Ukrainian legislation requires the use of protective equipment at military strike sites. According to the persons interviewed, even now not all fire stations have personal protective equipment for rescuers. (Matukhno 2023; Lisniak and Senchykhin 2023.)

As in Eastern European countries in general, the rescue services in Ukraine have had an abundance of staff. According to an interviewed source, this is perhaps the reason why it has not been considered necessary to start expanding the training of rescuers in war conditions, even though this is possible in principle. On the other hand, in 2022, SESU moved to double shifts to increase the number of emergency personnel on call (Kalynovskyi and Kovalenko 2023 ,151). According to the

interview data, it has now been possible to discontinue this exceptional arrangement despite the continuation of the war, and currently the Ukrainian fire departments follow the same 1+3 rhythm as in Finland.

3.6.4 New capabilities

The overall understanding of the Finnish experts interviewed is that SESU has been very successful in bringing its operations and capabilities to wartime standards, especially considering the conditions and requirements set for its operations.

Numerous persons interviewed stated that more CBRNE units for rescue services have been established in Ukraine during the war. Based on the information received, these are located in the areas of large cities, especially Kiev. The ability of ordinary fire stations to carry out measurements and clear chemical hazards has also been improved. This preparedness is apparently due to chemical emissions from both conventional weapons and attacked industrial plants (see Chapter 3.13.2). Ukrainian sources also expressed doubts as to whether Russia, which otherwise violates the laws of war, respects international conventions prohibiting the use of chemical weapons.

Humanitarian mine action has been one of SESU's key tasks to support their own operational activities and as part of civil defence activities. According to an interviewed source, SESU has more than tripled the number of its own mine clearing staff from the six hundred preceding the war. Numerous different technological solutions have been introduced in the surveying, mapping and clearing of mines and explosives. Efforts have been made to increase the use of dogs trained for this task. Actors in Ukraine have also gained good experience on new methods for the identification and survey of mines by equipping drones with customized sensor packets, including different types of cameras and magnetometers. In addition, clearance is carried out using more traditional robots, manually and with mechanical mine clearing vehicles. Mechanical demining is a new skill for SESU, and it has received over 30 mechanical mine clearing vehicles from foreign partners (SESU 2023; Mine Action Review 2023a, 373-374). As Russia has also targeted military strikes at ports and sea mines laid by both parties of the conflict wash on the coast, SESU has also been forced to develop its underwater demining capacity (Mine Action Review 2023b, 242).

No references to specific qualitative development work on urban search and rescue can be found in the material. Development has apparently mainly comprised increasing the existing capabilities by increasing the number of personnel trained for the tasks and the material resources. According to one interview very good experiences have been gained from the use of dogs in urban search and rescue, and SESU also aims to increase this resource.

3.6.5 Command system

Since 2015, Ukraine has been developing a situation center network for security authorities - SESU, the police and the National Guard. This network consists of a national command center and the situation centers of different security agencies and regional administrations that operate under it. The centres have standardised their technical capabilities, communication tools, and information processing systems. The network also includes permanent and mobile backup facilities, which can even replace the national command center if necessary (Tiutiunyk et al. 2023).

The Ukrainian fire station network is considerably denser than in Finland. Based on the interviews, each station also has its own control room for telephone and radio traffic. At the beginning of the Russian invasion, communications at the local level were based on analogue radio. Russian troops could easily listen in and disrupt communications and send false messages using stolen devices. For this reason, rescuers stopped using radios very quickly and moved entirely to various mobile communications applications. During the war, Ukrainian rescue services have switched to encrypted network services and secure digital radio connections. The police and other security authorities also operate in the same radio network. (Kalynovskyi and Kovalenko 2023, 151; SESU 2023.)

According to one of the persons interviewed, rescue departments and other authorities continue to suffer from a lack of mutual trust. There has been a variety of sabotage, for example the re-mining of areas that have been cleared once. In addition to immediate operational disruptions, lack of trust and fear of spies also hampers planning and increases the personnel's stress. Corruption also continues to affect Ukrainian authorities, although in this respect the administration has taken many preventive measures (OECD 2024). Overall, relatively little information is available on the subject.

3.6.6 Rescue services resources

SESU has encountered both personnel and equipment losses during the war. From the beginning of the war until the end of 2023, 83 SESU employees died as a result of military activities and 309 have been injured. Most of the losses were incurred in the early months of the war. This was due to the aforementioned lack of personal protective equipment, the rapid movement of front lines and the fact that rescuers being caught up in battles (SESU 2023).

Based on the interviews, the mental resilience of rescuers has become an increasingly important issue in terms of human resources. Especially due to the quantity and the condition of people's remains, finding the bodies of those who have died in military attacks is much more stressful than coming across the bodies of those who died in peacetime accidents. Similarly, the continuous threat to rescuers on assignments is stressful. As SESU is a national actor, it has been administratively easy to organise a system for temporarily rotating personnel from the west of Ukraine to work in eastern parts of the country close to battle zones (MSB 2023a, 26). This reduces the workload and stress of the personnel in the eastern parts of the country, but - as the Finnish expert commented - it spreads the stress and uncertainty caused by the war to rescue personnel and their families and friends throughout the country.

Responding to weapon effect-related tasks increases the consumption of a wide range of equipment. A larger number of car tyres and fire extinguishing hoses break than during normal times due to the rubble along the roads resulting from military strikes. Significant amounts of tools are also used up for the clearing, dismantling and supporting of ruins. Due to the large number of oil fires, the consumption of extinguishing foams has been high throughout the war (Lisniak and Senchykhin 2023). According to interviewed sources, in addition to rescue services, the consumption of health care supplies has also increased substantially, judging by support requested by Ukraine (Ministry of the Interior 2024a). One of the interviewed persons summed up that material needs are so enormous in the conditions of modern warfare that countries being attacked are in practice forced to rely on international aid.

Equipment losses are also significant in war conditions. According to the interviewee, an average of three fire engines are still lost per month in military attacks. Due to the threat of artillery, drone and missile attacks, the placement of the equipment at fire stations has been changed to maximise their protection. Fire departments have begun to park fire engines in firehouse with the nose inwards, which means that any fragments penetrating through the door will damage the equipment at the rear of the vehicle, which can be repaired more easily, instead of the engine and the cab (Kalynovskyi and Kovalenko 2023, 157-158). The persons we interviewed have explained that although Ukraine has received material support from abroad, rescue departments especially in rural areas continue to use Soviet equipment.

The people we interviewed consistently stated that the level of preparedness at Ukrainian fire stations was poor at the beginning of the war. For example, food and drinking water had not been stored. Based on the requests for assistance Ukraine sent to other countries, preparedness at the national level was also insufficient. In particular, there was a major shortage of CBRNE material. In the early stages of the war, Russia's attacks on fuel supply and fuel hoarding by the population caused a fuel shortage. Due to problems with electricity distribution caused by the war, rescue departments also need diesel-powered generators to ensure the continuity of their operations (Kalynovskyi and Kovalenko 2023, 147-148).

In order to maintain the functional capacity of personnel and equipment, fire stations have had to undertake preparedness measures. In addition to power outages and water cuts, the loss of heating, either due to attacks on critical infrastructure or direct damage to the station building, is a key risk. According to the interviewees, the stations have made an effort to create solutions to isolate parts of the garages with temporary partitions and to heat these spaces with various types of space heaters, even stoves.

3.7 Host nation support and reception of assistance

Ukraine has been able to continue its defence and maintain central government and social functions largely through extensive material support from other countries. The support has been provided to both the Ukrainian armed forces and the civilian sector. Based on documentary and interview material, foreign material support has also been essential for maintaining the functional capacity of civil defence (MSB 2023a, 34-40). This section briefly describes the system of host nation support in Ukraine and the logistics for receiving assistance.

3.7.1 Host nation support

During the war, Ukraine has been able to create a very well-organised governance system for the coordination and logistics of foreign material support. This is based on the continuous maintenance of communications infrastructure, the logistics network and civil-military cooperation. The Polish authorities have strongly supported the maintenance of the host nation support capacity of Ukraine, taking over part of the administration and providing the relevant Ukrainian authorities with the opportunity to work on Polish soil, safe from Russian long-range weapons attacks (MSB 2023a, 34-40). According to the interviewees, Ukraine's membership in the EU Civil Protection Mechanism has also been an important factor in the organisation of assistance.

According to Finnish interviewees who are familiar with the matter, SESU has significantly improved its ability to receive assistance during the war, and the support system works very well. The Ukrainian authorities compile up-to-date information on material needs within the country. SESU coordinates the collection and distribution of material requests in its field, but works in a very cross-administrative manner with other expert authorities. The lists of needs compiled in this manner are communicated to the partner countries, which offer the material at their discretion and the Ukrainian authorities approve what they want to receive. This makes the system considerably more effective than if it were based on bilateral relations.

In the case of material assistance, the only area of receiving assistance that attracted criticism in the material is the equipment needed for demining (see section 3.2.2). This is primarily due to the fact that the equipment needed are largely dual-use items.

3.7.2 Logistics of material support

Based on the interviews, the logistics of support arriving in Ukraine is based on the hub system. The material is first collected in neighbouring countries, mainly Poland, from where it is transferred to intermediate storage facilities in Ukraine. Although the locations of these warehouses are likely to be known to Russia, they have not been targeted. The aim is to distribute the material from the warehouses to the areas as quickly as possible.

3.8 Russia's method of warfare

The war in Ukraine also provides an opportunity to examine the Russian way of war. As, in practice, only Russia can currently pose a military threat to Finland (Government of Finland 2024), its combat methods should be taken into account when considering how to improve the functional capacity of Finnish civil defence in the conditions of an armed conflict. This chapter describes changes in Russia's strategy during the war and the most important weapons systems and methods of warfare affecting civil defence.

3.8.1 Russia's strategy and changes to it

Russia's attack on Ukraine can be divided into stages and it can be concluded that Russia has pursued various strategic objectives during each of these. Russia has changed its method of warfare to meet its new objectives, which has created changing problems for civil defence in Ukraine. (Jasinski 2023, 45; Aebi et al. 2024; Rimutis 2024, 3.)

Russia's war of aggression against Ukraine so far can be perceived roughly in three stages. The first phase of the war consisted of Russia's decapitation attack, during which it attempted to take over Kiev in February-March 2022. Following the failure to capture Kiev, Russia quickly withdrew its attack columns and regrouped them to battles in eastern and south-eastern Ukraine in summer and autumn 2022. In the early stages of the war, front lines moved rapidly, which caused extensive evacuations and put civilians at risk in other respects. Especially in eastern Ukraine, Russia also used a large amount of artillery in areas inhabited by civilians, in the same way as it has done during other wars it engaged in during the 2000s. (Jasinski 2023, 45–46.)

In winter 2022, Russia launched a strategic campaign against critical infrastructure in Ukraine, with the apparent aim of breaking the will of the Ukrainian population. After Ukraine survived the winter and developed its air defence against cruise missiles and drones, Russia could no longer maintain the intensity of its campaign. It has then varied according to the overall situation of the war and the stockpiles of long-range weapons available to Russia. (Aebi et al. 2024, 11.)

In spring 2024, Russia changed the focus of its long-range attack campaign against infrastructure by shifting attacks from the power grid to power plants. The objective was apparently to further destabilise the entire electricity transmission network. Strikes targeted in particular the system's regulating power plants. After the strikes, the power plants require long repairs, and it was also not easy to physically protect the locations to be repaired. (Matuszak 2024.)

Warfare in Ukraine has been characterised by an increase in the strategic importance of cities. This is apparent in long and devastating siege battles, such as those in Mariupol and Bakhmut. The reason for this phenomenon is partly Ukrainian geography, which in many areas does not offer geographic lines that would be easy to defend, and the relative small number of troops in relation to the length of frontlines. According to an interviewed source, the dependence of Russian armed forces' logistics on rail transport has forced it to target population centers at the intersections of important railway lines in Ukraine. (Ljungkvist 2022)

Long sieges and urban battles have naturally been devastating for the civilian population, who have not had time, the desire or the ability to evacuate from cities. Russia's urban combat tactics using massive firepower, such as indirect fire by artillery and drones, puts civilians at particular risk and creates major problems for civil defence. (Ljungkvist 2022.) In addition, Russia has also used 'grey area' chemicals such as tear gas in Ukraine (OPCW 2024). Video material on the use of white phosphorus is also available (e.g. BBC 2023a).

Although, according to OHCHR (2024b), Russia has killed nearly 12,500 civilians in Ukraine, the experts interviewed pointed out that killing civilians is not so much an objective for Russia as a side effect of warfare. Strikes on civilian targets are primarily aimed at damaging the Ukrainian economy and society's basic functions and weakening the population's will to defend. This is linked to the long-standing concept in Russia's military thinking of the deep battle, which aims to influence the enemy both in its spatial depth - in the entire area it controls - and in society through weakening the economy, critical infrastructure, cognition and the population's will to defend the country. (Reach et al. 2002.)

3.8.2 Strikes with long-range weapons

The Russian methods that has the greatest impact on civil defence has been strikes with long-range weapons. The long-range weapons Russia has used in Ukraine have included conventional and rocket artillery, various unmanned aircraft, glide bombs, as well as cruise, hypersonic and ballistic missiles. Various missiles have been launched into Ukraine from land, air and Russian naval vessels in the Black Sea.

As described above, Russia has struck a great deal of critical infrastructure and civilian targets protected by international humanitarian law with its long-range weapons. In addition to infrastructure, the targets have included hospitals and public administration buildings. Strikes on

hospitals have also been typical of Russian warfare in Syria, for example. Attacks targeting hospitals have mainly been carried out using artillery and infantry weapons as part of wider fighting in urban areas. (PHR 2023, 10–18.)

In addition to Russia's long-range weapons, during extensive missile and drone attacks, the civilian population has also been endangered by Ukraine's own air defence munitions and missiles. Despite self-destruct mechanisms, these weapons or parts thereof fall to the ground. Ukrainian sources have been quiet about this phenomenon, so the severity of the hazard cannot be assessed on the basis of the available data. However, one Ukrainian S300 interceptor missile has been documented to have fallen on Polish soil and killed two people (Reuters 2023).

Ukrainian sources also claim that Russia targets long-range weapon strikes randomly on the basis of signals intelligence. For this reason, mobile phones were not kept on in hospitals at the beginning of the war. Russia has also carried out a large number of missile and drone strikes at night, when the response capability of fire departments and civil defence has been clearly poorer (Lisniak and Senchykhin 2023).

Based on Ukraine's experience, different building types can withstand strikes by long-range weapons in very different ways. Especially old blocks of flats built from concrete elements have proven susceptible to collapse (Juurvee 2022, 2-5). According to interviews, of newer building stock buildings with extensive glass facades are especially dangerous. These will break even when relatively far from the targets of the attacks and, depending on the nature of the pressure wave, they pose a great danger to people either inside or outside the building.

Russia has also attacked dams with long-range weapons (BBC 2023b). One of the persons interviewed pointed out that as a result of such attacks, there is a risk not only of floods but also a danger that military explosives will be carried by flood waters downstream. In addition, flood waters spread toxic waste and chemicals contained in industrial plants and farms that caught in the floods, as well as from bottom sediments picked up by the current. Strikes on hydropower plants also cause disruptions in the electricity grid and reduce production capacity (Rimutis 2024, 4).

3.8.3 Mining

Mines have also been an important part of Russia's warfare in Ukraine. It has been reported that Russia uses numerous types of both anti-personnel and anti-tank mines. Especially in areas where the Russian army has settled in for long-term defence, it is reported that troops have set massive amounts of mines to support their defence. Contrary to its own commitments under international law, Ukraine has also started using landmines itself. Mine fields pose a threat to civilians who live in the battle zone or return to the area, especially to farmers who try to return to their work as soon as possible after the battles have subsided. From the perspective of civil defence, conventional minefields are the least dangerous form of mining. (Mine Action Review 2023a.)

Ukrainian sources have reported extensive use of explosive traps in civilian targets as Russian troops have retreated, especially in the early stages of the war while retreating from Kiev. The material includes references to toys and toilets in residential building, which have been equipped with grenades or explosives (Mine Action Review 2023a; Matukhno 2023, 108-109). Although this type of reporting must be treated with certain caution because of its apparent propaganda value, the use of

explosive traps has also been reported in other conflicts in which Russia has been involved in recent years (e.g. Hiznay 2021). This type of mining, which is more difficult to locate, recognise and clear, poses a danger to civilians and civil defence.

Unexploded objects constitute their own danger. The Swedish army estimated the share of unexploded Russian grenades and missiles to be 10%. In addition, munitions and explosives stored in abandoned trenches remain in the field. Some of these have been booby trapped by troops who have abandoned the stations, while others may become chemically unstable due to temperature fluctuations and humidity, creating a danger for civilians who may find them. (MSB 2023a, 17–18.)

Cluster bombs are identified in the material as the most dangerous form of mining. These are small explosives loaded into missiles and artillery and rocket launcher ammunition, spreading from the cargo projectile in the target area. It is estimated that up to 40% of Russian cluster bombs will spread into the terrain without exploding. From the beginning of the war of aggression, Russia has also used cluster munitions to attack settlements. Attacks of this kind cause a large number of civilian casualties and also pose a major threat to rescuers. As the sub-munitions are spread over a wide area and can be equipped with very wide variety of trigger mechanisms, they are also extremely difficult to clear. (Mine Action Review 2023a; 2023b; also see GICHD 2022.)

3.8.4 Cyber warfare

Russia has engaged in cyberattacks against Ukraine since 2014. With respect to this, it has clearly underperformed during the actual war of aggression in the utilisation of cyber weapons. In analyses focusing on the topic (e.g. Kukkola 2024; MSB 2023a), this has been estimated to be due to poor preparation for a long-term conflict on the one hand, and to the cyber defence capability developed by Ukraine from 2014 onwards.

Even before the actual beginning of the war, actors connected to the Russian state carried out extensive website hijacking and denial of service attacks against the Ukrainian central government, economy and communications networks (Kukkola 2024, 53-58). Efforts were made to disrupt the synchronisation of Ukraine's electricity grid with that of the EU (see Chapter 3.2.2). In the early days of the war, regional disruptions were successfully caused for the electricity grid and the mobile phone and internet networks. Despite these disruptions, these operations failed to achieve the strategic objective of paralysing the Ukrainian government and society. (Kukkola 2024, 60.)

Despite the limited impact so far, Russia has shown a willingness to use cyber weapons that physically destroy critical infrastructure. For example, after its siege on Kiev failed, Russian hackers tried to use malicious software to destroy numerous transformers, but did not succeed. (Kukkola 2024, 66.) However, the most important and successful cyber weapon used by Russia have been DoS attacks that hamper communication and citizens' access to official services (Kukkola 2024, 104).

Russia has also sought to launch operations that utilise cooperation between cyber and other types of weapons. For example, the communication systems of the Ukrainian authorities have been disrupted at the same time as strikes have been carried out with long-range weapons. This has proved to be very difficult in practice. However, it is estimated that Russia will continue to develop such capabilities, so the combinations of cyber and physical attacks are a phenomenon that Finland's

civil defence services should also prepare for. (Aebi et al. 2024, 26–27; Kukkola 2024, 129; Martisiute and Técourt 2024.)

3.8.5 Double-tap strikes

As described in section 3.6.2, Russia's double-tap strikes cause a major danger to rescuers. Double-tap strikes are those in which the same target is hit again after a brief period of time. Russia has also used this tactic in other conflicts during the 21st century.

Double-tap strikes achieve numerous goals. In addition to the direct destructive effect, the preparedness measures described in section 3.6.2 clearly slow down rescue operations, which hinders the limitation of damage and the carrying out of temporary repairs. If the first attack has caused civilian casualties, the risk of another attack increases the psychological impact of the strike. Several of those interviewed assessed that these were more important factors than killing the rescue personnel.

3.8.6 Espionage and sabotage

There is relatively little information available in open sources on the activities of saboteurs and spies working for Russia in Ukraine. Most of the people interviewed were not aware of such a phenomenon. However, one of the persons interviewed knew that these actors became activated before the actual war of aggression and began to disrupt the actions of the rescuers by making false alerts, the apparent purpose of which was to create uncertainty and force the rescue authorities to prioritise their activities. In addition to false alerts, there are indications of espionage activities targeting rescue services in strategic areas.

After the war began, Russian-minded people were apprehended in Kiev and other large cities, equipped with Russian targeting devices. In the run-up to the Russian attack, disguised sabotage groups aiming to spread chaos and attack civilians and infrastructure also infiltrated into Kiev (Rudenko 2023, 62). There is limited reliable information available on the subject, but it seems that the overall impact of these groups was limited. On the other hand, sabotage behind Ukrainian frontlines in eastern Ukraine was a more significant threat.

3.8.7 Most significant threats to civil defence and civilians

According to interviewed persons, artillery fire and drones have been the most significant threats for rescuers and civil defence. The random targeting of artillery fire at settlements has damaged fire stations and caused casualties. On the other hand, it is cost-efficient to use drones to attack individual fire engines etc. According to data gathered during interviews, the Russian army also targeted rescue services in the occupied areas with violence. Fire stations have been destroyed, equipment broken and stolen, and personnel beaten.

Most of the civilian losses have arisen during the war in situations where frontlines have moved and civilians have been caught up in the battles. 90% of civilian casualties have been caused by the explosive effect of long-range weapons. (UNHCR 2024c, 15–17; OHCHR 2024a.)

3.9 Points of Invincibility and assistance to the population

Ukraine has taken various measures to assist the population, three of which will now be examined briefly. These activities include the establishment of Points of Invincibility, assistance to civilians to help them cope with everyday needs, and various security communication and training campaigns.

3.9.1 Points of Invincibility

Points of Invincibility are points set up in population centers that provide assistance to the civilian population in meeting their basic needs. The most important services of the centers are the possibility to charge a mobile phone, access the Internet via a Wi-Fi connection and a heated space where people can stay temporarily. In addition, depending on the point, basic first aid, food and psychosocial support may be available (MSB 2023b, 22).

The Points of Invincibility seemed to appear quite spontaneously. According to an interviewed source, at the beginning of the war, civilians sought help and information at fire stations, schools and similar public institutions, at which time the staff of the organizations started to provide them with the necessary services where possible. The concept was then copied by actors such as village associations, NGOs and shopping centers. During the collection of the data, the situation regarding basic services was so good in Kiev that the points were not in use, but numerous sources indicate that a thousand Points of Invincibility could be set up in the city at a few hours' notice.

The persons interviewed believed that Points of Invincibility were a highly functional and important service for the civilian population.

3.9.2 Assistance of civilians

In addition to the essential humanitarian assistance provided to internally displaced persons and those who have lost their homes, Ukraine has gained good experience in the distribution of cash assistance (OCHA 2023a). This is based on the fact that the loss of jobs and problems in the financial system are the main obstacles to the population’s coping with everyday life. There has been no shortage of food at any point. This makes cash assistance both logistically easier and flexible and empowering for the recipient. However, some of the persons interviewed criticised this method of assistance as a way of feeding corruption and its potential impact on inflation.

Another noteworthy method of assistance is the ready-made building repair packages, which have been collected at warehouses to be distributed to people whose homes have been damaged by fighting or Russian attacks. In the winter, broken windows make homes uninhabitable. The packages, which include supplies such as timber and tarpaulins, allow people to make temporary repairs in their homes themselves, so that they do not have to find a temporary apartment or evacuate. (OCHA 2023b.)

3.9.3 Safety communication and training

Based on the interview data, Ukraine has also launched a strong education campaign on the dangers related to the war. This includes both fixed and mobile safety classes, during which civilians are

shown various mines, military explosives and other dangerous remnants of war. A chatbot has also been set up online, and residents can ask for advice when encountering potentially dangerous objects. Safety education have been particularly targeted to children.

3.10 Warning of the population

Warning activities, i.e. alerting the population to natural conditions and the dangers arising from human and, in particular, military activities, is a key part of civil defence. During its defensive war, Ukraine has successfully developed its own alert system and introduced innovations that Finland can also learn from in its own development work. This chapter discusses alert systems, their effectiveness, i.e. the response of the population, and finally some observations on blackout activities.

3.10.1 The overall warning system

At the time Russia's war of aggression on Ukraine began, the Ukrainian population's warning system was primarily based on sirens. However, according to the interviewed sources, Russia managed to disrupt the use of the siren system, which originated from the Soviet era. Even when they functioned, sirens did not cover large areas (Juurvee 2022, 7). According to an Ukrainian interviewee, the cell broadcasting system introduced by SESU before the war, which was to intended to send a warning message to all mobile phones in a certain area, did not function as expected and the population lost confidence in the alerts it gave.

According to several interviewed sources, alerts and warnings were transmitted at the early stages of the war mainly between private persons with mobile phones. Rescue authorities continue to use applications such as Telegram and Whatsapp to manage work matters. When the authorities provided limited information on the development of the situation, mainly via television, the population is reported to have moved rapidly online, especially on social media, to search for more information (MSB 2023a, 31). In addition, according to interview data, the administrators of the city district groups on the Telegram communications service, which was very popular in Ukraine, began to provide information on air alerts to their residential areas.

During the war, Ukraine has succeeded in creating a population alert system, which the interviewed experts consistently believed to be very effective. The most important part of the system is the mobile phone application, but also the sirens, cell broadcasting, social media channels and the interruption of TV and radio broadcasts with alert messages are still in use.

3.10.2 Warning application

The Air Alert mobile application is a key innovation for the Ukrainian warning system. Depending on the threat, the application can be used to issue an air hazard warning covering the entire country or a single region, and to provide information about the end of the threat (Juurvee 2022, 7; Polyakov 2023). According to an interviewed expert, even before the beginning of Russia's war of aggression, each Ukrainian oblast had an on-call authority that received an up-to-date air situational picture

from the armed forces and was responsible for issuing warnings using the systems in place. Sending alerts via Air Alert was added to the tasks of these authorities.

The Air Alert application is operated and developed by Ukrainian security companies Ajax Systems and Stfalcon. During the collection of the data, negotiations on the transfer of the system and its costs to the Ukrainian State were ongoing, according to an interviewed source. The app utilises Amazon's and Google's cloud services. According to the interviewed source, Russia has not carried out cyberattacks on the application.

New functionalities have been developed for the Air Alert application during the war. As the population's response to alerts has decreased, Air Alert aims to provide as much information as possible on the quality of the threat so that people can make informed choices about seeking protection. In addition to various levels of air hazard alerts, it is able to warn about natural disasters, CBRN threats and combat operations (Tanasiychuk 2024).

In order to maintain general interest, a feature has also been added that allows users to change the voice that reads the alert texts to that of an actor or celebrity. According to one of the persons interviewed, there was a small-scale scandal when the voice on the app was changed to that of a Ukrainian public figure who had strongly divided opinions in Ukraine. The case underlines the importance of creating and maintaining trust also in this type of official communication.

On the basis of the interview material, it is reasonable to assume that Russia is consciously using Air Alert as a tool for influencing the population of Ukraine. The take-off of military aircraft with hypersonic missiles will automatically trigger an alert throughout Ukraine, so Russia's armed forces will fly these weapons systems at night to cause unnecessary alerts, with the aim of making the population grow indifferent to danger.

In addition to Air Alert, other applications supporting civil defence have also been introduced in Ukraine to warn the population of mined areas and the location of the nearest civil defence shelters (Juurvee 2022, 6-7).

3.10.3 Population response to alerts

In Ukraine, the civilian population generally responds well to the air alerts. According to the experiences gained during the war, an effort should be made to access bomb and civil defence shelters within 2-4 minutes after an alert sounds (Syshkin and Pankeieva 2024, 232).

Research evidence shows that citizens have sought access to shelters less and less as the war has progresses. In the statistical analysis, long and repeated stays at shelters are a key reason for the decline in response to alerts. On the other hand, the accuracy of the alerts does not seem to have an effect on people's willingness to access shelters. In other words, people simply grow tired of seeking shelter month after month, at worst many times a day. (Van Dijcke et al. 2023.)

Individuals close to the targets of Russian strikes and those who live close to the front line respond better to alerts. Communication supporting alerts, for example on national anniversaries when Russia is expected to strike, has also been found to have an impact on seeking shelters. It can therefore be concluded that a broader communication strategy is needed alongside technical alert solutions. On the other hand, alerts of different levels also give the population agency, and in this

case, at least during the most serious alerts, people are more active in seeking shelter. (Van Dijcke et al. 2023.)

3.10.4 Blackout activity

Most of those interviewed were unaware of blackout activities in Ukraine. However, some interviewed sources suggested that Ukraine might implement blackouts for two reasons.

First, in some situations, electricity may have been proactively cut off from areas targeted in strikes with long-range weapons. The aim would be to reduce the damage caused by attacks on the electricity network and to prevent the disruptions resulting from physical damage to the network from spreading to the wider grid.

Following attacks, Ukraine may also have implemented limited power cuts, especially at night, to prevent Russian drones from recording the targets of the attacks and produce estimates of the damage these attacks caused.

3.11 Civil defence shelters

Before the war, there were a very limited number of civil defence shelters in Ukraine, mainly built in large cities during the Soviet era. During the war, the country has begun to quickly build different types of shelters based on the lessons learned and the needs observed. Although the situation in Ukraine differs significantly from that in Finland, the measures introduced there are also interesting for the development of civil defence in Finland. This chapter briefly describes Ukraine's civil defence strategy, technical solutions for shelters and their equipment.

3.11.1 Civil defence strategy and scenarios

A key finding of the project is that Ukraine had not prepared for the long-term use of civil defence shelters before the Russian war of aggression (Polyakov 2023). Now the country has moved to the 'new normal', during which shelters are often used daily. This creates new requirements for their usability and equipment.

According to interviewed sources, there were few shelters at the beginning of the war and their regional coverage was poor. Property owners were responsible for maintaining and operating the shelters. Due to corruption, not all facilities intended for protection had even been built and not all were fit for use. Ukraine has initiated the strong drive to construct new shelters, and legislation on shelters has also been reformed during the war.

At the beginning of the war, local administrations showed initiative in mapping and informing the public on the shelters and facilities suitable to be used as shelters in their area and how these were equipped (Brovko 2024, 7). During the war, NGOs have also carried out this type of survey work (Iatsyna and Zawadzki 2023, 65).

3.11.2 Access to shelters

Due to the poor state of the shelters at the beginning of the war, in numerous cases, the spaces designated as shelters were locked in February 2022 when the population sought to access them (Rudenko 2023, 26). As the war has continued, efforts have been made to ensure the accessibility of shelters by equipping them with ramps, wheelchair lifts and Braille signs as far as possible.

In Ukraine, a mobile phone application has been developed that allows people to find the closest shelter when warning sirens begin to sound (Juurvee 2022, 6-7). The Ukrainian administration has apparently discussed the extent to which information on the location of shelters would be distributed. Finally, the information has been made fully public.

3.11.3 Structure and technology of shelters

Numerous different types of shelters has been introduced in Ukraine during the war. Some shelters are similar to Finnish civil defence shelters, which also protect against CBRNE threats. Some provide limited protection against radioactive fallout. The largest number of shelters built in Ukraine only protect against explosions and shrapnel, which provides protection against conventional weapons and are also simple and cheap to maintain. For example, very simple shrapnel shelters are built for bus stops from concrete elements. (Shipiliarevych et al. 2023.)

In addition to the actual shelters, the population has been instructed to convert suitable facilities, such as cellars, into shelters. On a large scale, metro tunnels and underground parking garages have been used for this purpose. According to Ukrainian guidelines, any space located underground or where there are two walls between people and outdoor air can be used for this purpose. In principle, such facilities should be equipped with dry toilets and 48-hour food supplies. (Shipiliarevych et al. 2023.) However, cellars in blocks of flats, which are not built for protective purposes and do not have two exits, have also proven to be dangerous because they cannot withstand the collapse of the structure on top of them (Juurvee 2022, 5).

3.11.4 Equipment in shelters

According to the interviewed experts, in situations in which shelters are used continuously, the manner in which they are equipped playes a very important role. Shelters must be comfortable, hygienic and suitable for different population groups, and they must be tolerable for longer periods of time so that the population will use them repeatedly. The possibility for communication is also important so that information can be provided on air alerts and their end.

According to interview data, the new Ukrainian shelters are systematically equipped with emergency power feeds or generators, charging plugs and Wi-Fi connections. The shelters are also equipped with cooking facilities, furniture and other amenities. Under reformed Ukrainian legislation, all large civil defence shelters must have the opportunity to divide the space so that children under the age of 11 and pregnant and breastfeeding mothers can stay in a separate space (Shpiliarevych et al. 2023, 580). The civil defence shelters built in schools during the war aim to create opportunities to continue teaching in classroom-like facilities (Moja fortetsia, no date).

3.12 General order

As with sabotage, little material is available on the deterioration of public order during the war. For reasons that are easy to understand, Ukraine has no interest in reporting phenomena that undermine the image of national unity. Even so, the subject falls within the scope of civil defence and must be taken seriously in the context of military emergency conditions.

According to an interviewed source, at the beginning of the war in Ukraine, as Russian troops progressed, the Ukrainian police had to withdraw, leaving the frontline residential areas with no law enforcement. In the early stages of the war, curfews lasting several days were declared in Kiev. The reason given was that this hampered the movements of Russian sabotage groups. However, the mayor of Kiev also banned the sale of alcohol and announced that looters would be "liquidated on sight" (Klichko 2022). Ukrainian first-hand sources also report large-scale looting, for example, of homes residents had evacuated (Rudenko 2023, 111-113).

According to the interviewed experts, public order in other parts of Ukraine also collapsed in places and, for example, the looting of shops was widespread. This may have also resulted from the efforts of ordinary people to build up their home supplies for the duration of the crisis. In the early stages of the war, videos also spread from Ukraine, in which ordinary residents had assaulted looters and taped them to traffic signs as a form of public humiliation (France24 2022).

3.12.1 Corruption

Corruption has been and continues to be a major social problem in Ukraine. Significant cases of corruption have also been revealed in connection with civil defence during the war. As public sector procurement regulations have been eased during the war, this has opened up opportunities for criminal activities, and significant fraud has been uncovered in civil defence procurement (e.g. NABU 2024; see also SESU 2023, 28). SESU has introduced its own internal, anonymous whistleblowing-line for reporting corruption cases (SESU 2023).

3.13 Environmental security

Russia’s war of aggression in Ukraine has also created various threats to environmental security. In many respects, these threats are not directly related to civil defence, so they have been excluded from this report. However, observations are available from Ukraine on radiation safety and chemical threats caused by the war, which can also be utilised in the development of civil defence in Finland. This chapter briefly discusses radiation safety and chemical threats in Ukraine.

3.13.1 Radiation safety

Russia has shown disregard for the safety of nuclear facilities during its war of aggression. For example, the operation of the Chernobyl and Zaporižja nuclear power plants has been disrupted as a result of battles and long-range weapons targeting buildings housing the plant’s support functions. Although there has not been an immediate risk of radioactive discharge in these cases, Russia’s actions have also led to a number of situations where the plants’ connections to the electricity grid

have been disrupted or completely cut off. When prolonged, such situations pose a risk of radiation accidents, as nuclear plants need energy to cool reactors and spent fuel elements even when they are not in use. (Nikolaieva and Zwijnenburg 2022.)

According to a information provided to Finnish experts, a network of 450 measuring points for the measurement of radiation and airborne chemicals has been created in Ukraine, which monitors radiation levels in the country and transmits the information to the authorities.

3.13.2 Chemical threats

Strikes with long-range weapons that have targeted various industrial and agricultural facilities, storage facilities and electrical industries also pose a threat of chemical emissions (Nikolaieva and Zwijnenburg 2022). According to the interview data, SESU has for this reason invested in increasing the CBRN capability of rescue workers. The reserves of plants using hazardous chemicals have also been emptied or reduced to a minimum. This has been possible in part because many industrial plants have suspended their operations during the war. In addition to direct military attacks, disruptions in the electricity network also create risks in industrial plants handling chemicals (Nikolaieva and Zwijnenburg 2022).

4 Recommendations

This chapter presents the recommendations for Finland produced by the project. The recommendations have been drawn up both based on observations and by directly selecting suggestions emerging from expert interviews and documents.

As stated in the section on project limitations, the recommendations are primarily based on information regarding Ukraine. Due to limited time and availability of information, their feasibility and connections with the current situation in Finland were not examined in depth. Instead, the following recommendations are intended to prompt the responsible authorities to assess their own development, training and further research needs.

4.1 Key differences between Ukraine and Finland from the perspective of civil defence and protection of infrastructure

Any treatment of lessons learned in Ukraine and recommendations based on them should begin with an acknowledgement of certain significant differences between Finland and Ukraine. Considering these differences is necessary to ensure that lessons learned from the war can be appropriately applied when developing civil defence in Finland.

Firstly, it should be noted that Ukraine's transition from peace to war did not take place on 24 February 2022. In practice, Ukraine had already been fighting a war in Donbass for ten years. During this period, Ukraine also received assistance from its partner countries to develop its governance and capabilities (see Mills 2022). The development of civil defence in Ukraine during this period has been excluded from the scope of this project. Nevertheless, it is worth emphasizing that Ukraine had recent experience in areas such as combating Russian cyber warfare and civilian-military cooperation on different levels of government. Despite this, at the beginning of the war of aggression, Ukraine failed in, for instance, at the material preparedness of civil defence and rescue services and the evacuation of civilians. This highlights the difficulty of success in these measures.

Secondly, it should be noted that the geostrategic position of Ukraine is significantly different from that of Finland. The most obvious of these differences is land mass. In terms of area, Ukraine is almost twice the size of Finland. Its strategic depth is considerably greater, especially in the East-West direction. From a civil defence perspective this affects, for example, the placement of internal refugees.

Although maritime transport via the Black Sea was an important channel for imports and exports for Ukraine, the country also has a long land border with both Poland and Romania. For this reason, Russia's strategic capability to cut off foreign support through military action is limited. Finland's international logistics connections are considerably more dependent on sea routes, which would be considerably more vulnerable in times of war (Government of Finland 2024, 66). In addition, Ukrainian electricity, rail and road connections are far more interlinked than their Finnish counterparts (see Aebi et al. 2024), which has enabled circumventing damaged parts of the network in ways that might be impossible in Finland.

The economic and societal structures of Ukraine also significantly differ from those of Finland. Due to its Soviet past, Ukrainian rescue services have significant human resources. Many services are provided by state-owned companies that have not outsourced their own support functions to the extent done in the West. For example, the Ukrainian national railway company can still produce the most common spare parts for repairs using its own facilities (Aebi et al. 2024, 21–22). In addition, Ukraine is not as urbanised as Finland: In Ukraine, 70% of the population live in cities; in Finland the percentage is 86% (World Bank 2024).

Moreover, the international political position of Ukraine and Finland are not comparable. Since Ukraine is not a member of the EU or NATO, its administration has had a certain freedom of action, for example in transferring sensitive administrative data to foreign servers. As a non-NATO country, Ukraine is fighting a war in a situation where other European countries are not in a state of emergency but can focus on supporting Ukraine. In most scenarios where Finland enters a state of emergency due to a military threat, almost all other European countries would also be under military threat due to their NATO commitments. Material assistance for civil defence would probably not be available to Finland to the same extent as for Ukraine today.

4.2 Preparedness

4.2.1 Drills and training

Investing in regular and practical drills in practicing for emergency conditions. Numerous sources of the project estimate that SESU had not practiced for emergency conditions frequently enough and that drills were not practical and realistic enough to prepare rescuers and officers for actual need.

4.2.2 Maintaining administrative capacity

Planning for the early dispersion of central government functions in the face of military threat, including the civil defence and rescue services. Paralyzing central government functions with long-range attacks is a key part of Russian strategy, which was demonstrated in Ukraine as well. In practice, dispersion of functions is the only way to defend against these types of attacks. In addition to dispersion, criteria for starting the implementation of necessary measures should be created to support decision-making (Juurvee 2022, 4.)

4.2.3 Information systems

Developing digital services proven useful in Ukraine. In Ukraine, these include the registration of internal refugees, the registration of separated family members, the production of digital copies of lost documents, a database of volunteers assisting in rescue and civil protection activities and a database of civil protection measures (see Koivukoski, 2025).

Investigating whether access to central government information systems and registers can be disconnected and blocked in temporarily occupied areas. In Ukraine, Russians have used e.g., patient databases to identify persons who previously served on the Donbas front to subject them to

retaliatory measures (PHR 2023, 45). In terms of information security, the ability to remove local copies of databases and to disconnect access to servers in certain areas would be useful.

Switching to satellite Internet connections during extensive and long-term connection interruptions. Although Russia has likely failed to disrupt Ukrainian telecommunications to the planned extent, the interruptions in communications have still been massive, hampering civil defence functions. In Ukraine, the Starlink system has proven to be an effective back-up system during these disruptions. However, its use has been associated with problems related to covering costs as well as risks posed by dependency on a single service provider (Aebi et al. 2024, 28). Therefore, the early identification of reliable systems is recommended.

4.2.4 Clearing

Planning the command structure and resourcing of extensive humanitarian mine clearing in advance. In Ukraine, the lack of such planning and governance has clearly hampered the organizing and effective implementation of humanitarian mine clearance. Plans must enable the quick creation of a national mine clearance strategy that is suitable for the situation, if necessary. (Mine Action Network 2023a, 2023b.)

4.2.5 Public alerts and communication

Producing a public alert system resistant to interference, based on a situational picture produced by the Finnish Defence Forces. The system should be able to issue regionally targeted alerts on various incidents and threats. This is one of the main recommendations of the project. In Ukraine, the Air Alert application has been proven to reduce civilian casualties. It is likely that a similar application for use by the Finnish authorities could be prepared with the support of existing administrative and technical solutions. This could be e.g. an update add-on to the existing 112 application.

Developing a mobile phone application to warning of landmines and other area hazards. These kinds of applications have proven useful in Ukraine as well. Integrating such a system with the abovementioned public warning solution could be possible.

Conducting a study on the adequacy, protection, reliability and development needs of a multi-channel public alert system. The existing alert systems in Ukraine at the start of the war proved insufficient, requiring rapid development of new solutions.

Considering insufficient civilian response to alerts in planning emergency action. Based on the Ukrainian experience, prolonged emergency conditions can cause alert fatigue among the civilian population, slowing their response to e.g. air raid alerts. These findings should be taken into account in planning.

Developing a more extensive communication strategy for emergency conditions that supports immediate alerts. In Ukraine, the population has been found to react better to alerts received in situations where immediate alerts are supported in advance by other communications. For example, a connection was found between warnings given before Ukrainian National Day about likely Russian attacks and a better alert response (Van Dijcke et al. 2024).

Developing population alerts and emergency communication in key social media channels. Under emergency conditions, the Ukrainian public quickly began seeking and sharing information in social media channels. It is important that reliable official information is available also in these channels.

4.2.6 Supporting the population

A study producing various scenarios for supporting the population in different long-term emergency conditions. Although emergency conditions cannot be fully predicted, making necessary arrangements is easier if sufficient preliminary information is available. Such information should cover responsibilities for distributing aid and for facilities in different scenarios as well as monitoring, budgeting mechanisms and type of aid. In Ukraine, for example, financial aid distributed by the UN to internally displaced persons was found to be a quick and flexible solution in a situation where markets remain in operation but pose a risk of increased corruption and inflation.

Local authorities must systematically survey companies, warehouses and industrial facilities located in their operating area that are potentially useful for assisting the population in emergency conditions. In Ukraine, such a survey was not started until after the war started. If compliant with uniform standards and kept up to date, such a survey would noticeably improve the ability of municipal governments and rescue and civil defence authorities to utilise available resources quickly and independently in emergency conditions.

Preparedness for supporting the civilian population remaining in population centers during long-term urban warfare. Experience in Ukraine shows that the civil defence plan should assume that even after evacuation there will be civilians remaining in cities, either because they are unable to leave on time or are incapable or unwilling to leave. In addition, cities have many functions and host critical infrastructure. The upkeep of this infrastructure requires civilian staff who cannot be evacuated, at least in the early stages of the fighting. The growing strategic importance of cities and the Russian strategy of massive use of firepower and siege warfare makes the protection of the civilian population and meeting their basic needs during armed conflict highly demanding.

Preparedness for material support for the temporary repair of buildings damaged in a military crisis. In Ukraine, there are good experiences of distribution of repair materials to residents of damaged buildings. Relatively minor damage, such as broken windows, may make an accommodation uninhabitable, especially during winter. Distributing supplies for simple temporary repairs can reduce the need for emergency accommodation and facilitate, to the extent possible, the normal daily life of the civilian population.

Determining the necessity and preparedness for establishing points providing electricity, wifi-connections, first aid, heat, and psychosocial support in the way of Ukrainian Points of Invincibility. In Ukraine, Points of Invincibility have become one of low-threshold means of assisting and supporting the civilian population in emergency conditions. Although the success of the Points of Invincibility can partly be attributed to their spontaneous origin and an adaptation to the needs and opportunities of each area, preparing the concept for implementation by, for example, various NGO's, would be a relatively cost-effective measure.

4.2.7 Critical infrastructure

Preparing for increasing the physical protection of transformers. Long-range strikes against power grid transformers are highly likely in any future armed conflict. Planning the protection of transformers and storing prefabricated, quick to install concrete element shields would be a cost-effective preparedness measure (Rimutis 2024, 14). As outlined in Chapter 3.3.5, this type of protection cannot be expected to prevent destruction by long-range weapons, but it would reduce the extent of repairs or increase the cost of attacking such targets.

Ensuring the availability of key spare parts and repair personnel for electrical infrastructure in emergency conditions. In addition to protection, the capacity to repair the electricity network and power plants has proven important in Ukraine. In Ukraine, efforts are made to ensure the adequacy of resources by reserving personnel and by tax exemptions for necessary parts and equipment. However, Ukraine has suffered a shortage of spare parts throughout the war. The adequacy of spare part emergency stockpiles must also be investigated in Finland and, if necessary, the applicable regulations updated.

Exploring the potential for decentralisation of energy production. In 2024, Ukraine began planning the decentralisation of electricity production to smaller plants (Matuszak 2024). Similar measures may also prove necessary in Finland in a prolonged armed conflict. Preliminary investigation would provide a basis for more detailed planning work for the implementation of decentralisation, should the need arise.

Ensuring the black start capability of the Finnish power grid. While Russia has failed in disabling the entire power network in Ukraine through cyber and physical attacks, the country's authorities and the energy sector have had to prepare for this. Damage to the grid can cause a knock-on effect, causing the grid to fail completely when transformers and power plants power down as a safety measure. Recovery from this status, a so-called 'black start', is a highly demanding operation that requires careful planning and coordination, especially if the network has sustained physical damage. The longer the blackout, the more difficult the operation becomes, as reserve power runs out and different types of power plants suffer from being offline (Popik 2022, 41.) As disabling the power grid may be part of a military first strike, the ability to recover must be ensured well in advance.

Investigating the maintenance of nuclear power plant safety during a long-term power grid disruption. Referring to the previous recommendation, nuclear and hydroelectric power plants are particularly vulnerable when they suffer a prolonged loss of external power. Nuclear power plants require energy for the continuous cooling of reactors and spent fuel. In addition, uncontrolled shutdown can cause the reactors to suffer neutron poisoning which temporarily prevents restarting. These factors warrant particular attention when investigating the resilience of the electricity network and its recovery in emergency conditions.

Investigating the impacts of extensive evacuations or similar population transfers on the operation and adequacy of critical infrastructure. The migration of millions of people in Ukraine from the southern and eastern parts of the country to the west has caused imbalances in supply and demand, for example in terms of electricity consumption and telecommunications. Especially with regard to electricity, the adequacy of resources and transmission infrastructure are not the only concerns, but also have to do with securing the operating conditions of industry businesses in case demand dramatically and unexpectedly increases.

Preparedness for repairing critical underground infrastructure in emergency conditions. Long-range weapons have broken underground cables and pipes in Ukraine (Jasinski 2023, 51). There might be an increased need for maintenance and repair of such critical infrastructure in emergency conditions.

4.2.8 Stockpiling

Developing the preparedness stocks for wellbeing services counties and collaborative areas. In emergency conditions, the demand for healthcare supplies may increase dramatically and deviate significantly from normal conditions. The upkeep of sufficient preparedness stocks for collaborative areas for healthcare and social welfare and wellbeing services counties must be investigated and, if necessary, updated.

Ensuring the decentralisation of preparedness stocks and special equipment through regulation and planning. During military emergencies, emergency stockpiles for healthcare, rescue services and civil defence are a potential target for long-range attacks and sabotage. Adequate decentralisation through planning and regulation is the most effective way to ensure that stocks are maintained.

4.2.9 Evacuations

Evacuation of civilians early in the crisis should be planned from the perspective of both administration and political decision-making. Making decisions related to evacuations under military threat is a very difficult administrative and political decision. In particular, the economic, social and political costs of large-scale population transfers are high. A hostile actor may also seek to benefit by delaying its own actions to create a sense of incompetence of political and administrative decision-makers. It appears that evacuations in Ukraine were not begun in time due to such reasons, even if intelligence supporting the decision was available.

In Finland, the decision to evacuate and its execution depend on mandate, i.e. which of the following the evacuations are based on: the Emergency Powers Act, the Rescue Act, or the State of Defence Act. Evacuation decisions during war or the threat of war are primarily made under the powers of the Emergency Powers Act after the Government and the President have determined that the country is facing emergency conditions. The powers of the Rescue Act enable so-called protective evacuations. As a rule, such an order is issued by the rescue authority under the Ministry of the Interior and, if necessary, the rescue authority of a given wellbeing services county. The state of defence imposed by a Presidential Decree gives the defence authorities the power to order the population to move from an area subject to an attack or a similar immediate threat (Ministry of the Interior 2024a, 28). It is advisable to investigate potential legislation or criteria that would give political and administrative decisions structure and support to justify possible calls for evacuation to citizens.

Plans must be created to guide and support the self-evacuation of the population, for example using public transport resources, in cooperation with civilian and military authorities and NGOs. Based on available data, this kind of guidance and support was inadequate at the beginning of the war in Ukraine. According to Ukrainian Railways, support measures such as using railways to relocate and aid internally displaced refugees, were undertaken mostly spontaneously.

In Finland, Ministry of the Interior guidelines emphasise independent evacuation of the population into a safe area. Authorities support independent evacuations through communication. In evacuations, the authorities' resources must be allocated to a vulnerable population in need of assistance (Ministry of the Interior 2024a, 31). However, authorities' assistance allocation and cooperation with actors in other sectors should be continuously improved.

Operating procedures for evacuation from temporarily occupied areas. In Ukraine, evacuations from areas temporarily occupied by the Russian armed forces have proven dangerous. Civilians who have tried to leave the areas independently have been at particular risk. Conversely, evacuations carried out as convoys require planning, logistics and communications resources and coordination between the military and civil authorities. Drafting preliminary plans for such evacuations would be an effective way of reducing civilian casualties in the event of a military crisis.

The possibility and need to encourage the partial evacuation of large population centers to rural areas in emergency conditions must be investigated. As has been discussed, according to the Ukrainian experience, meeting the basic needs of the population in large population centers may be difficult in the conditions of a modern conventional war. Urban homes are highly dependent on the operation of basic infrastructure, such as the electricity network and district heating, especially in winter. Finland's preparedness planning could be supported by a separate study examining the possibility of encouraging some of the population to temporarily move to accommodation in sparsely populated areas where at least heating could be decentralised. The study should also examine the social, economic and civil defence repercussions of this type of population transfer.

Why a part of the population refuses to comply with evacuation orders must be investigated. In Ukraine, a part of the population has been found to be unwilling or unable to comply with evacuation orders even when fighting approaches, which puts them at risk and may further burden civil and military authorities. A separate study examining the causes of the phenomenon in Ukraine and the prevalence of these causes in the Finnish population would produce information that could be useful for planning and increasing the efficiency of evacuations.

4.2.10 Transport

Preparedness for long-range weapon attacks at junctions. Attacks with long-range weapons were part of the Russian decapitation strike on Ukraine. Since then, the number and targets of attacks on logistics have varied according to Russia's changing strategic objectives. Planning should involve the Defence Forces to make use of the best available information regarding various military conflict scenarios.

4.2.11 Businesses and industry

Local authorities must have a standardised method for mapping businesses, warehouses and industrial facilities that are hazardous under emergency conditions. Russian attacks and damage to the electricity grid have caused hazards in facilities where e.g. hazardous chemicals have been stored and handled. Finland needs a standardised method and frequency for regional and local authorities to map the status of such facilities and the possible consequences of their faults or emissions in emergency conditions.

4.2.12 Safety communications and training

Communicating about dangers posed by armed conflict to the population, especially to children, must be planned in advance. In Ukraine, these kinds of communications have been prioritised and implemented using both fixed and mobile teaching facilities (Mine Action Review 2023a). In Finland, mapping training needs required in different exceptional circumstances and designing the content to be used in advance is recommended.

The gender perspective must be considered in civil defence, health care in emergency conditions and the education of the population. In Ukraine, the gender perspective has been successfully integrated, for example, in the planning of humanitarian mine clearance and the equipping of civil defence shelters. Taking the gender perspective into account can improve the effectiveness of civil defence shelters and healthcare in emergency conditions (e.g. Mine Action Review 2023a, 368). This must be a crosscutting theme in planning civil defence and preparedness.

4.2.13 Environmental risks

The resistance of various building types against different weapon effects and their consequences should be assessed. Based on Ukrainian experience, the single greatest hazard to civilians is building debris caused by explosions (e.g. missiles and artillery shells). Fragments from broken structures can kill and injure across a large area. Large glass façades have proven particularly dangerous for people both inside and outside buildings. In addition, different types of buildings pose different risks of collapse and fire under attack. Projects are currently under way in Finland to develop methods to simulate the impact of various accidents on different types of buildings (Juutinen et al. 2023, 58–60). These methods could also be applied when studying the resistance of existing Finnish buildings against the effect of weapons.

The ability of other authorities to utilise data transmitted by the Finnish radiation measurement network should be investigated. During the war, Ukraine has created a network of radiation measurement stations to prepare for the use of nuclear or radiological weapons and war-related accidents in nuclear facilities. Finland currently has approximately 250 external radiation measurement stations, the readings of which are transmitted every 10 minutes to the USVA system maintained by the Radiation and Nuclear Safety Authority and to emergency response centres. Users of the USVA system include the Ministry of the Interior, the Finnish Meteorological Institute, the Defence Forces, rescue departments and nuclear power companies. The Finnish Meteorological Institute is responsible for the weather data that supports radiation monitoring in the USVA system (STUK 2011, 6). Although the technology already exists, it may be necessary to investigate how different authorities are currently able to receive and utilise measurements, especially in emergency conditions. In addition, the integration of the data produced by the network into the abovementioned public warning application should be investigated.

Developing a network of chemical measurement stations in population centres. The network of measuring stations established by Ukraine during the war measures not only radiation but airborne chemical concentrations as well. The creation of a similar system in Finland, possibly in connection with the aforementioned radiation measurement network, warrants investigation.

Considering research into the consequences of attacks on dams and similar structures in preparedness. Russia has used both long-range weapons and other destructive methods against Ukrainian dams and hydroelectric power stations. It would be beneficial for preparedness to draft an up-to-date report on the impacts of similar dam destruction in Finland.

4.3 Rescue services

4.3.1 Rescue services administration

Development of civil-military cooperation between rescue personnel and the Defence Forces. During the war, the Armed Forces of Ukraine have created CIMIC groups for the exchange of information and local coordination between the armed forces, civil authorities and the civilian population. Such a differentiated task is probably not necessary in Finland, but advance planning of local civil-military cooperation could still reduce conflict and delays, improving information flow.

Ensuring the exchange of information between local governments and central agencies through organisational and technological solutions. It appears that in the early stages of the war in Ukraine, exchange of information and instructions between central, regional and local governments was substandard. The problem was apparently caused by both organisational and practical communication problems. Based on this experience, drafting comprehensive report on the organisation of communications between different Finnish authorities in emergency conditions and their secure practical implementation is recommended.

Ensuring the functioning of the payroll administration of civil defence and rescue services in emergency conditions. Disruptions in Ukrainian electricity and communications networks have hampered the functioning of the financial system during the war. This has also affected the daily lives of rescuers and their families, which in turn has consequences for personnel availability and task performance. Preparations should be made for paying critical personnel at least partially and temporarily in cash or through other secure means.

4.3.2 Training

Adding mines and other military explosives to rescuers' (in-service) training. Each Ukrainian fire station had, at least in principle, personnel trained to identify mines and military explosives. During the war, mines and explosives have proven to be a significant threat to rescue personnel. In Finland, in-service training should aim for each fire department being able to secure its operations in emergency conditions by surveying and identifying mines and explosives.

4.3.3 Cooperation

Preliminary planning of cooperation with NGOs. In Ukraine, NGOs have proven to be an important resource in supporting civil defence. In addition, many non-governmental organisations, whose operations were not related to civil defence during peacetime, have refocused their activities after the start of the war and used their organisations and to help, for example, internally displaced

persons. Preliminary plans should be made in Finland for using similar support in emergency conditions.

Preparation of coordination centres for emergency conditions to promote cooperation between authorities and critical industries. In Ukraine, creating wartime coordination centres for coordinating activities of authorities and critical industries and to harmonise the cyber defence of certain industries has been deemed necessary. The creation of similar partnerships in Finland should be investigated.

4.3.4 Equipment resources

Preparedness planning for a situation where rescue vehicles losses increased for prolonged periods. In Ukraine, fire department vehicles have seen continuous losses throughout the war. Vehicles are still being written off in accidents and attacks at a rate of approximately three vehicles per month. In addition, vehicles are continuously out of service due to minor damage and worn parts. Finnish rescue services must draft preparedness plans for situations where vehicle use and losses are high for a prolonged time.

Preparing for increased consumption of fire hoses, tyres and extinguishing foam. The war in Ukraine is evidence that the demand for the consumables of rescue departments increases dramatically under emergency conditions. When planning emergency conditions for Finnish rescue departments, the possibility of a similar peak in consumption must be anticipated and planned for in emergency stockpiling.

Investigating reserving blast-resistant shipping containers for rescue services. Finland has delivered blast-resistant shipping containers to Ukrainian rescuers. These serve as temporary rest facilities on longer missions. The need to obtain similar containers for Finnish rescue departments must be investigated.

The need to procure special equipment needed in military emergency conditions must be investigated and the coordination of its use developed. For instance, the need to decontaminate equipment and property may increase considerably during armed conflict. National coordination and resource transfer capabilities could be produced by a national system where all special equipment is registered and its storage and use coordinated. SESU uses such a system.

4.3.5 Human Resources

Developing the personnel reservation procedure for rescue organisations. Although Ukrainian rescue services have greater human resources than Finland, SESU has also had to change work shift arrangements and rotate personnel between different parts of the country to ensure sufficient human resources. Finnish rescue services, largely based on the capabilities of contract fire brigades, differ significantly from those in Ukraine. Reserving contract fire brigade personnel for rescue tasks in emergency conditions is a known problem (e.g. Leinonen 2024, 47) that urgently requires solutions, as experience in Ukraine has shown.

Creating models to protect the mental well-being and resilience of rescue personnel. During military emergencies, rescue personnel experience prolonged and heightened levels of psychological

stress when compared to peacetime. The main reasons for this are the dangers to rescuers on missions, the number of casualties in military attacks and the condition of the human remains that they encounter. High-quality work is already being done in Finland to improve the mental well-being of rescuers (e.g. Finnish Association of Fire Officers, no date). This work should continue. Psychological aftercare of employees in different fields after crisis management deployments and other foreign operations as well as domestic major accidents should be compared and developed as a whole.

4.3.6 Capabilities

The water supply and heating of rescue stations should be prepared to operate independently. Ukrainian fire stations have had to take measures to ensure water supply and heating. Disruptions may be caused by attacks against infrastructure or the stations themselves. These disruptions in services can affect the performance of both personnel and equipment. Finland should develop options and allocate resources for e.g. the storage of drinking and technical water as well as the partial insulation and heating of vehicle bays.

Standardisation of emergency stockpile and fuel stockpile upkeep. Especially at the beginning of the war in Ukraine, rescue departments experienced local difficulties in procuring sufficient fuel and other consumables due to military attacks and exhausted commercial stocks. The adequacy and harmonisation of preparedness measures taken between different Finnish stations and rescue departments should be examined.

4.3.7 Protection

Preparation of protection and decentralisation measures against armed attacks at fire stations. In Ukraine, fire stations have suffered damage from Russian attacks, especially near the front. For this reason, various means have been used in effort to protect stations and equipment. Preliminary planning of similar protection activities would be a cost-effective way of ensuring the continuity of rescue services.

4.4 Rescue operations

4.4.1 Command and control system

Developing a network of command centres that enables cooperation between different levels of administration. In order to form a situational picture and ensure the necessary support for local operators, cooperation between command centres at different levels should be further developed. Wellbeing services counties should have their own command centres and procedures for working with municipal centres. Ukraine has been forced to extensively develop cooperation between different levels of government during the war.

Development of mobile command centres for rescue services. Russia has struck administrative targets in Ukraine, due to which Ukraine has had to develop temporary command centres to

mitigate attacks on the primary centres. Some of the temporary command centres in Ukraine are mobile, and this concept should also be studied in Finland.

Effective prioritisation capability in rescue services command & control. The war in Ukraine shows that, in a military crisis, the number of emergencies in a short period may exceed the availability of equipment and personnel. For this reason, efficient data processing and the prioritisation of tasks are vital capabilities.

Sufficient channels and processes for civilian and military authorities for coordinating the use of drones in emergency conditions. Military drones pose a major threat in the war in Ukraine. The Ukrainian military and civilian authorities have had to develop close channels for coordinating the use of rescue drones so that they do not cause unnecessary alarm or interfere with the fight against Russian drones. It is likely that similar challenges would also face Finland during military emergencies. Therefore, clear coordination networks should be set up to harmonise drone operations of different authorities already during peacetime.

Making communication devices for civil defence and rescue services harder to locate by adverseries. Some Ukrainian sources have reported that Russia is using signals intelligence to select targets for long-range weapons. For this reason, Ukrainian railway command centres, for example, do not use the easily trackable Starlink system. The vulnerability of communication devices used by Finnish civil defence and rescue services should also be investigated.

Planning must consider the many exceptional circumstances that extend the response times of rescue services. In Ukraine, the response times of rescue departments have constantly increased in war conditions due to e.g. congestion, traffic control disruptions, debris blocking streets and the time needed to survey sites. Similar factors can be assumed to apply to Finnish rescue services in the context of an armed crisis, and the delays caused must be considered in planning.

VIRVE network security in emergency conditions. In Ukraine, rescue services were still using analogue radio at the beginning of the war. These proved to be highly vulnerable to Russian eavesdropping and interference. During the war, the rescue services have switched to the shared digital radio network for all authorities. The VIRVE network, similar to the system in place in Ukraine, is already in use in Finland. However, due to Russia's capabilities in digital warfare, the safety and resilience of the VIRVE network should be continuously assessed. In addition, the need to protect VIRVE network base stations and improve their backup power systems should be assessed.

4.4.2 Cooperation

Inclusion of spontaneous volunteers in rescue operations. Responding especially to long-range strikes in Ukraine, keen individual civilians have voluntarily participated in rescue operations and have proven an important resource. There is no specific legislation in Finland regulating cooperation between the authorities or rescue organisations and spontaneous volunteers. However, the coordinating party is subject to regulations that ordinarily apply to employers, for example concerning liability, safe working environments and occupational accident insurance. It is important for authorities and organisations to plan in advance how to cooperate with spontaneous volunteers. Issues that should be taken into account include the establishment of notification centres, communication between different parties and volunteers, catering, and how to manage

spontaneous volunteers (Emergency Services Academy Finland 2020). Developing and drafting applicable legislation is recommended.

4.4.3 Capabilities

Rescue services' EOD capability to support operations. Mines, cluster bombs and military explosives have proven to be a significant threat to civil defence operations in Ukraine. If explosives are detected, rescue operations at the site are suspended until the explosives are disposed of. As in most European countries, SESU had EOD capability which has been greatly increased as the war progresses. Conversely, Finnish rescue departments lack independent EOD capability. Instead, the task falls under the responsibility of the Police and is executed by the Defence Forces. Developing EOD capability to supports the rescue services' operations should be investigated.

Underwater EOD capability of rescue services. Throughout the war, the Black Sea shores and Ukrainian seaports have been contaminated by both cluster bombs and sea mines laid by both belligerents. SESU has therefore had to develop an independent capability for underwater explosive ordnance disposal. As Finland is highly dependent on sea cargo and a military conflict could increase military activities in the Baltic Sea, Finland should investigate and develop sufficient underwater EOD capability to protect ports.

Rescue services resources and training for on-site chemical intelligence and protection against chemical hazards. In Ukraine, extremely toxic fuels from Russian missiles and chemical emissions from industrial plants hit by attacks have proven to be a significant threat to rescuers. SESU has reacted to this threat by strengthening the rescue departments' capability for chemical intelligence and for protecting personnel against chemical hazards. Finland should also investigate the need to develop similar capabilities.

Assessing and developing training and equipment to enhance rescue services' urban search and rescue capabilities and capabilities at rescuing from high places. In Ukraine, buildings collapsed in military attacks have resulted in a great need for the skills and equipment for working high places as well as urban search and rescue. It should be assumed that the same phenomenon would be repeated in Finland in the context of a military conflict. The level of preparedness for urban search and rescue varies across Finland. The City of Helsinki Rescue Department has prepared for urban search and rescue with e.g. specially trained rescue teams and the necessary special equipment. Only a few other rescue departments are prepared for urban search and rescue due to limited availability of the required special skills and equipment. Helsinki Rescue School gives rescuers basic urban search and rescue training whereas Emergency Services Academy does not. At other rescue departments, skills have largely been acquired on international rescue service courses organised at the Emergency Services Academy until 2022. Approximately half of those who have received international training in urban search and rescue ruin come from outside the rescue sector, which makes their utilisation in a war situation more difficult (Tuominen & Korhonen 2024, 33–34). Regional performance improvements and ensuring the availability of personnel in emergency conditions should be investigated.

Contingency plans must be created for situations where the supply of fire-fighting water is hampered due to damage to infrastructure. In particular, massive attacks with long-range weapons

create many simultaneous fires that are difficult to extinguish. At the same time, attacks on power and water supply may make it more difficult to access fire-fighting water. In Ukraine, rescue departments have had to develop new solutions for pumping fire-fighting water from natural waters across great distances. Developing this capability in Finland should be considered.

Rescue services must prepare for new tasks, such as the distribution of food and water and the handling of deceased persons in emergency conditions. Distribution of humanitarian aid to the civilian population has become an important new task for SESU staff out of necessity. Similarly, searching and transporting civilians killed in the war has occupied rescuers (cf. Tuominen & Korhonen 2024, 40). The resources required for such tasks must be taken into account when planning rescue services in emergency conditions.

Developing competence in extinguishing oil fires. The project material shows that oil fires in the oil industry and electricity infrastructure sites emerged as particularly demanding in Ukraine (Lisniak and Senchykhin 2023, 42–50). Based on this, it should also be examined whether Finland has sufficient expertise and material preparedness for fighting oil fires.

Use of drones in site surveys, especially in mapping mines. In Ukraine, drones have been successfully used in surveying military attack sites, especially when they have been equipped with sensor packages specifically designed for the task. Developing similar capabilities for Finnish rescue services is recommended.

4.4.4 Protection of operations

Specific tactics for emergency conditions should be created. These should take into account the need for small surveying units to check sites for possible explosive and chemical contamination, and the maximum distribution of units on site. In Ukraine, these tactics have been adapted at sites of military attacks due to the risk of double tap attacks and chemical and explosives hazards. Finnish rescuers would face similar threats in a military crisis, and therefore Ukrainian tactics can be used in the development as a basis of development.

Rescue departments must develop and practise procedures for situations where the units on missions may be targeted by enemy weapons. SESU personnel suffered significant casualties and equipment losses at military attack sites especially at the beginning of the war. It would be important to develop the rescue departments' ability to maintain their situational picture and evacuate personnel and equipment if a site proves dangerous due to the above-mentioned reasons and the personnel who first arrived at the site suffer losses.

Preparations should be made for rescue services operating methods that could be used to prevent hostile influencing, such as false alarms and espionage activities, during emergency conditions. Before the beginning of the war, a great deal of harassment was directed at Ukrainian fire stations mainly in the form of false alarms. In addition, suspected espionage activities were observed near stations. Preparedness for hostile action and operating models for emergency conditions should be under constant development and review in Finland. Field C&C systems (KEJO, PEKE) and other data systems should also be able to store, analyse and compile a situational picture of such activities.

Using an air surveillance controller in rescue services tasks. In Ukraine, drones and double tap strikes have resulted in rescuers on site always having one air surveillance controller maintaining an airspace situational picture and, if necessary, order the dispersion of personnel and equipment for protection. Similar procedures must also be included as an option in Finnish rescue service plans.

Taking into account the possibility of sabotage and targeting on rescue services' missions in emergency conditions. Various acts of sabotage and use of targeting devices for air and missile attacks have been observed in Ukraine. Rescue personnel must be able to identify and react to such action, and the possibility of sabotage must be taken into account in the planning of other activities.

4.5 Emergency and medical care

Mapping the capabilities of hospitals and emergency medical services in emergency conditions. During a military crisis, the need for primary and medical care increases considerably while societal resources are directed elsewhere. A comprehensive investigation should be carried out on the ability of the health care system to handle situations where it is simultaneously affected by e.g. personnel shortages due to mobilisation, a significant increase in the consumption of basic supplies and changes in demand caused by the internal displacement of people (See also HE 210/2024.)

4.5.1 Emergency medical care

The ability of emergency care to treat large numbers of fragmentation wounds. During the war in Ukraine, rescue and emergency medical personnel have had to undergo additional training in life-saving care. This is primarily because of the quantity and severity of fragmentation wounds caused by military attacks are greatly increased.

4.5.2 Medical care

The capability of the health care system to treat large numbers of severe burns, chemical injuries and injuries requiring amputation during a state of emergency should be investigated. The war in Ukraine has shown that modern warfare produces significant numbers of burns, chemical and fragmentation wounds as well as injuries requiring amputation among civilians and military personnel. The capability of the Finnish health care system to treat large numbers of such injuries should be examined.

Hospital evacuation teams. Specific teams should be responsible for transferring both personnel and patients to civil defence shelters and, if necessary, to medical facilities in safer areas.

Hospital heating plans for emergency conditions. The most common damage suffered by Ukrainian hospitals has been windows broken by nearby explosions. Especially in winter, broken windows put patients in mortal danger and prevent treatment. Hospitals must prepare plans and materials for temporary repairs that enable the facilities to remain sufficiently warm even if the buildings are damaged.

Mobile clinics to temporarily replace damaged healthcare facilities. In Ukraine, the capabilities of hospitals and health centres damaged beyond use have been partially replaced by mobile clinics that

have provided essential care in population centres while hospital have undergone repairs. Similar arrangements should also be investigated in Finland.

Patient transfer possibilities to Sweden and Norway in emergency conditions. The burden on the Ukrainian health care system has been reduced by transferring patients requiring demanding treatment abroad, especially to Poland. For Finland, the most obvious countries for such evacuations would be Sweden and Norway. The potential for such an arrangement should be proactively investigated.

4.5.3 Human resources

Models should be created to prevent the emergence of PTSD among nursing staff to secure human resources. Similar to rescue personnel, medical personnel are under exceptional long-term psychological strain in times of war. This is due to limited resources, patient numbers and injury types, all of which are very different from those seen in peacetime conditions. To ensure the availability of human resources, models for supporting the psychological resilience of personnel should be developed proactively.

4.6 Civil defence shelters

4.6.1 Scenarios and planning

Different sheltering scenarios as a basis for planning: e.g. evacuations after brief sheltering and the new normal in civil defence shelters. This is one of the key findings of the project. In both Finland and Ukraine, civil defence has largely been based on the assumption of a single brief stay in civil defence shelters, followed evacuation. The war in Ukraine has shown that there are other possible scenarios. Different scenarios require different types of planning and material preparedness, which must be considered in all planning and preparedness.

A policy on marking or camouflaging civil defence and rescue objets. It was debated in Ukraine whether civil defence shelters and similar sites should be disguised or clearly marked, with the latter approach being used in the end. This is supported by international law, maximising the availability of civil defence shelters and protecting their civilian status from Ukrainian military action as well. Russian attacks on civil defence shelters were feared but few have been documented. An official Finnish policy on the matter should also be drafted.

Civil defence shelters must be equipped for use ahead of time. As previous studies (e.g. Government of Finland 2023, 65) have shown, Finland does not currently reach the goal of being able to make civil defence shelters operational in 72 hours. Similar problems also affected Ukraine at the beginning of the war. The results of this project, among others, highlight the need to improve the rapid deployment of civil defence shelters.

4.6.2 Equipping civil defence shelters

Automatic access to civil defence shelters could be developed e.g. by connecting their electrical locks to the alert application. Many Ukrainian civil defence shelters were inaccessable at the beginning of the war because they were locked and their keys unavailable when people tried to seek shelter within. It is technically possible to equip shelters with electronic locks that would open automatically in the event of an alert. This possibility should be explored.

Equipping civil defence shelters with external power inputs or generators, electric outlets and Wi-Fi. New Ukrainian civil defence shelters are equipped with an external power supply, charging outlets and Wi-Fi connection. This allows those sheltering to maintain situational awareness and quickly receive updates on alerts. In addition, the amenities increases the effectiveness of civil defence shelters as people are more likely to seek shelter within if their stay is comfortable.

Accessibility of civil defence shelters for persons with reduced mobility and visual impairments. Efforts have been made to add ramps, wheelchair lifts and signage for the visually impaired to Ukrainian civil defence shelters. Similar measures would also be appropriate in Finland.

Development of incontinence preparedness and general hygiene of civil defence shelters. Ukrainian accommodation centres for internal refugees have achieved good results in incontinence preparedness. Equipping civil defence shelters with incontinence pads and sufficient washing facilities improves hygiene and makes the shelters more appealing. This is especially true considering the ageing population and research results showing that more than half of minors traumatised in war suffer from bedwetting.

Equipping civil defence shelters for special groups (children, the chronically ill, etc.) Adding children's play areas, enough beds etc. to civil defence shelters primarily serves to increase the use of shelters and thus their effectiveness. The interior of a civil defence shelter could also be divided with mobile partitions accommodate many different needs.

School civil defence shelters should be developed to support children's safety, well-being and continued learning. Ukrainian schools have strived to build civil defence shelters that allow teaching to continue when sheltering. This both promotes learning outcomes and reduces psychological pressure on children. Similar arrangements should be further developed in Finland.

Durability and maintenance of civil defence shelter equipment in long-term, repeated use. As Finnish civil defence shelters are designed for relatively short-term use, their air conditioning equipment and filters, among other equipment, have a limited service life. The usability of standard shelter equipment in long-term and repeated sheltering scenarios should be investigated and development needs analysed.

4.6.3 Nonstandard shelters

The ability to produce simple bomb shelters as required. Fragmentation and blast-resistant structures have proven useful in Ukraine. These might take the form of e.g. prefabricated elements assembled in public places. Such structures are quick to erect and inexpensive to maintain.

Investigation of the '2 wall rule' and its applicability for Finnish sheltering guidelines. In the absence of other means of sheltering, the Ukrainian public has been instructed to seek a location at home or work where they are protected from external blast effects by at least 2 walls. The effectiveness and applicability of these guidelines for Finnish buildings should be investigated.

4.6.4 Recommendations of the official instructions for civil defence shelters project

The recommendations of the Civil defence shelter study's recommendations project are supported throughout by the observations in the Ukrainan opit project. Ukrainan opit has been a close partner to the project. The detailed recommendations for civil defence shelters and related administration should be used in development work along with lessons from Ukraine.

4.7 International cooperation

Mapping of procedures and resources for host nation support (e.g. facilities, communications networks) between civilian and military authorities and developing them to reflect current circumstances. The administrative capacity demonstrated by Ukraine to request and receive assistance from partner countries has been critical for maintaining the nation's military and civilian capabilities during the war. Finland has signed bilateral security of supply agreements with both Sweden and Norway. These agreements concern, for example, economic cooperation and the exchange of information in crises. Cooperation among the countries has also been promoted in trilogue. Finland has also participated in the planning of the EU Civil Protection Mechanism (Government of Finland 2022, 14–15, 17). Therefore, there are grounds to assume that Finland has sufficient host nation support capabilities should the need arise. However, the ability of the military and civilian authorities to cooperate in emergency conditions to guarantee the effective reception of aid and as well as its protection from military threats must be investigated.

4.8 Development work

An administrative mechanism for developing capabilities to meet the requirements of emergency conditions to maximum effect. In the project's interviews the ability of Ukraine to adapt to wartime conditions and develop its capabilities in response has been described as amazing. As it is impossible to anticipate every problem and detail related to emergencies, it is advicable to focus on mechanisms that can be used to develop civil defence and related activities in a flexible and controlled manner in response to given emergency conditions.

When training for emergency conditions, normal operations should not always be the default starting point. Instead, training scenarios might assume damaged infrastructure or disrupted telecommunications to begin with. Analyses of critical infrastructure in Ukraine have particularly found that in Ukraine, as in most other countries, disruption recovery training usually starts from and seeks to restore a state of normalcy. Training scenarios should more often be based on a worsening situation that requires participants to prioritise problems.

4.9 Legislation

4.9.1 Wellbeing services counties and municipalities

Accelerated administrative regulations and processes of local government for emergency conditions. In Ukraine, the state of war has significantly loosened regulations on public sector tendering and recruitment, which has enabled a rapid response to the needs that have emerged during the emergency conditions and the replacement of employees who have fled the war. It should be investigated whether current Finnish legislation enables similar flexibility, and the necessary processes developed.

Administrative mechanism that enables the rapid transfer of rescue personnel around the country in emergency conditions. As a national level actor, SESU has been able to rapidly transfer human resources around the country, which has been found a significant advantage. In Finland, similar transfers are possible at least within cooperation areas for rescue operations. However, the adequacy of such arrangements in emergency conditions warrants investigation.

4.9.2 Population transfers

Developing legislation and processes for internal refugees. Action plans must be drawn up for large-scale and long-term population transfers, and the necessary resources and data systems designed. The war in Ukraine has shown that the execution and administration of a large-scale population transfer is a very demanding measure for the authorities. A study should be carried out in Finland on the adequacy of current legislation and administrative and data systems for dealing with population transfers within the country or abroad, such as has taken place in Ukraine. In addition, the plans and resources of the wellbeing services counties and municipalities must be examined and, if necessary, standardised.

4.9.3 Rescue services

Personal protective equipment for rescue personnel against weapons and military CBRN threats. Ukrainian rescuers suffered significant casualties especially at the beginning of the war due to the lack of personal protective equipment. Shortages of such equipment continue to this day to some extent. The final report of the preliminary study on protective wear for rescue services, which concluded in 2024, recommended that protective equipment of this type be further developed and their inclusion in preparedness measures standardised in Finland (Ministry of the Interior 2024b, 26–27). Bulletproof helmets and vests have been purchased and used when necessary at least in some regions. However, the need to harmonise this kind of preparedness nationwide should be investigated.

Importing equipment necessary in emergency conditions should be facilitated in case of an emergency. In Ukraine, the difficulty of importing equipment has been among the key impairments for humanitarian demining. It appears that this is largely due to much of the equipment being dual-use products. Improving the flexibility of Finnish legislation in this respect, either in general or as part of state of emergency legislation, must be examined.

4.9.4 Critical infrastructure

Regulations on the backup power solutions of decentralised critical infrastructure should be updated. In Ukraine, telecommunications companies have been forced to independently develop reserve power systems for telecommunications towers during the war in order to maintain services during power outages. It should be examined whether applicable regulations should be prepared for Finland.

Preparing plans and regulation to release additional frequencies and enable a domestic roaming agreement between telecommunications companies in emergency conditions. The operation of the Ukrainian mobile phone network has proven to be crucial for maintaining the functional capacity of both the population and the authorities during the crisis. New frequencies have been released to help companies cope with disruptions and changes in demand. In addition the companies also direct traffic to each other's networks (Aebi et al. 2024, 29). Preparing for similar arrangements in Finland would be a very useful measure for emergency conditions.

4.9.5 Data processing

Transferring critical central government data to foreign servers in emergency conditions. The Ukrainian Government transferred critical central government data to foreign servers shortly before the Russian invasion began. The project material described this measure as very important for guaranteeing the functioning of the Ukrainian central government (Aebi et al. 2024, 28). The necessity and technical and legislative feasibility of such a measure should be investigated in Finland, if it has not been investigated already.

4.9.6 Anti-corruption and criminal investigation

Administrative crime prevention: Integrating anti-corruption and anti-trafficking measures and prevention of illegal trade into all official activities in emergency conditions. Crises, especially ones that involve extensive population transfers, pose an increased risk of exploitation of vulnerable groups, as well as human trafficking. The risk of corruption and black market trade increases in emergency conditions as well. Their prevention must be a crosscutting theme in all planning for emergency conditions and an integral part of official administrative functions. This is particularly important in a state of war. (See Jukarainen et al. 2023; Winter & Garselius 2025.)

Integrating criminal investigations into civil defence and rescue services to reveal suspected collaborators. Activities supporting Russia have been observed in connection with civil protection and rescue operations in Ukraine. These activities include e.g. planting targeting devices and re-mining cleared areas. Authorities and rescuers must have adequate capabilities and processes to document such observations to support criminal investigations and the detection of persons collaborating with the enemy.

Plans should be drawn up for ordering curfews, as well as cooperation between the authorities as well as military and civil actors during curfew. Extensive curfews were imposed in major population centres in Ukraine in the initial chaotic stages of the war to prevent both sabotage and looting. This

risk cannot be entirely discounted in Finland either. Plans for quick measures to counteract such risks should be developed.

5 Summary and evaluation of results

The results of the Lessons from Ukraine project can be divided into observations on civil defence in Ukraine and the impact of Russia's war of aggression on the one hand and, on the other, recommendations based on these observations. A number of broad themes can be identified in both.

The first theme is that Ukrainian civil defence authorities have had to adapt and develop their activities in wartime conditions that differ from expectations. The 'new normal' in Ukraine is a situation in which Russian long-range weapons threaten everyday civilian life month after month. At worst, civilians must seek shelter several times a day. Additionally, the infrastructure necessary for the civilian population is constantly under attack.

Ukraine has developed new solutions and increased its capacity to meet these challenges. A number of applications have been introduced in Ukraine to alert the public to various hazards of war, guide them to civil defence shelters, enable volunteering etc. Research evidence strongly indicates that these solutions have saved lives.

Ukraine has also launched a strong civil defence shelter construction campaign. Most of these structures are bomb shelters that protect against fragments and blast effects. The effectiveness of the civil defence shelters has been improved by equipping them with power outlets, Wi-Fi and amenities that increase the public's willingness to seek out and spend time in the shelters despite the onset of alarm fatigue. Other measures that maintain the functional capacity of the population and society include, for example, points of invincibility providing immediate grassroots level aid and material aid for restoring the habitability of damaged homes.

Another theme emerging from the observations concerns the Russian way of war. Firstly, it should be noted that during the war of aggression, Russian strategic objectives have varied from a rapid occupation to a war of attrition. Russia has changed the way it fights in line with these objectives, which has resulted in changing tasks and problems for Ukrainian civil defence and critical infrastructure protection as well.

In a prolonged war, the Russian military relies on massive use of indirect fire and long-range weapons. This can be viewed as a continuation of the deep operations concept that has long influenced Russian military thinking. A deep operation aims to affect the enemy across its entire depth. The most obvious example of this is the extension of attacks (or at least the threat thereof) across the entire geography of the target state. Russia also seeks to extend the impact to the national economy, societal functions and public resistance. For this purpose, unconventional means such as information warfare, destruction of critical civilian infrastructure, sabotage and cyber warfare are also used, although with the latter two Russia has clearly underperformed in Ukraine.

Russia has also shown disregard for international rules of war by attacking civilians, civil infrastructure, and heritage and protected sites. This has been primarily an attempt to break the Ukrainian will to resist. Civilian losses are not a primary objective for Russia, but such losses are also not avoided. In addition to direct attacks on rescuers, rescue services have had to change their tactics due to threats posed by mines, explosives, unexploded munitions and chemical contamination from weapons.

Thirdly, some tasks in which Ukrainian civil defence has not succeeded in the best possible way were identified in the project material. The most obvious of these was the delay in evacuations. Despite available intelligence and warnings, the population was not prompted to move in time. Local rescue authorities were also not sufficiently instructed in advance. This highlights the wider fact that civil defence is not only about administrative and operational activities, but also political involvement and decision-making.

At the beginning of the war, material preparedness of actors responsible for civil defence in Ukraine was also inadequate. In particular, there were insufficient equipment, such as shrapnel vests, military helmets, and CBRNE protective equipment for protection from armed conflict. In many places, no equipment was available.

The fourth set of observations concerns the host state support organised by Ukraine. Foreign support has enabled Ukraine to defend itself, also enabling its civil defence activities. The Ukrainian authorities have created a highly functional system that collects information on material needs from the operational level and centrally transmits requests for assistance to partners. Similarly, decisions to receive the assistance provided have been centralised. Material assistance delivery logistics operate efficiently via a central warehouse system. Ukraine's accession to the EU Civil Protection Mechanism and the support provided by neighbouring countries, especially Poland, have been key in host state support and logistics.

Fifth, information from Ukraine shows that critical infrastructure is impossible to protect in a modern conventional war. Despite the development of Ukrainian air defence, Russia's large-scale strikes using long-range weapons have repeatedly damaged particularly Ukraine's power grid. Ukraine has benefited from the decentralised nature of the overall architecture of its power grid. It has also sought to increase the resilience of infrastructure through decentralisation and rapid repairs. The primary aim of infrastructure protection is to reduce damage in order to reduce repair time and increase the costs of attacks to Russia.

Based on observations and expert interviews collected, the project has produced recommendations which can also be described through overarching themes. The first theme concerns the utilisation of digitalisation in civil defence. The most obvious example of this is the introduction of a warning system similar to Ukraine's Air Alert mobile phone application in Finland. Applications to alert about dangerous areas and guide people to the nearest civil defence shelter should also be considered. Ukraine has also introduced other digital tools for civil protection, such as registering volunteers, internal refugees and family members separated from each other. The need to develop such systems in advance should also be examined.

Secondly, rescue services must develop preparedness against military threats in terms of material preparedness, tactics, and the command and control system. Developing material preparedness includes, for example, the development of personal protective equipment, emergency stockpiles for fire stations, and equipment needed for sheltering and continuation of operations. Possible dispersion of resources should also be examined if necessary. From a tactical perspective, operating models should be created for reducing risks to rescuers, such as surveying sites using smaller units, dispersion of units, and increasing their evacuation readiness during missions. At the level of the command and control system, the capabilities to prioritise tasks should be strengthened as armed conflicts may significantly increase the number of simultaneous tasks.

The third set of recommendations concerns increasing the resilience of critical infrastructure. Based on the Ukrainian experience, the most important systems are power and heating, both of which Russia has targeted, especially in winter. Measures aimed at increasing resilience may include preparedness to protect targets from attacks of long-range weapons. The primary task of protection is to make repairs easier and faster. The adequacy of spare parts and personnel needed for repair work should also be examined. Similarly, the resilience of communications systems, especially the development and regulation of backup power systems, should be examined: numerous functions of civil defence and infrastructure maintenance depend on functioning communications.

Lastly, civil defence in Finland should also be developed to respond to different threat scenarios. As in Finland, civil defence planning had also in Ukraine been based on the assumption that civil defence shelters would be used for short periods at the beginning of the crisis and that subsequent evacuation of population would follow. However, there is a need to develop strategies for prolonged sheltering and various threats targeting the infrastructure and population. Examples of such measures in Ukraine include the construction of different types of shelters and the development of shelter equipment for repeated, prolonged and comfortable sheltering. Supporting the survival of the population in their homes in the event of damaged infrastructure, for example by providing building repair supplies, should also be considered. At the higher level, the ability of decision-making systems to identify different scenarios and changes procedures as emergency conditions develop should be improved. Similarly, enabling development work during crises and the dissemination of results should be taken into account.

The possibility of different threat scenarios is also a key aspect of assessing the observations and recommendations for measures made in the Lessons from Ukraine project. The observations and recommendations produced by the project are specifically lessons learned from Ukraine. They should be assessed and applied to Finnish civil defence and its development, bearing in mind the geographical and societal differences between Finland and Ukraine. If the military threat to Finland ever materialises, it will never fully correspond to the scenario now realised in Ukraine.

The project recommendations are meant as prompts. The project objectives, available resources, and access rights did not permit a thorough examination of different aspects and plans for Finnish civil defence. The project observations and action recommendations are intended as starting points for development and research work by the responsible authorities. They do not comment on the current status of these issues in Finland. Data to make such judgements was not collected in the project.

Within these limits, the Lessons from Ukraine project can be considered to have produced a comprehensive overview of Ukrainian civil defence activities during the Russian war of aggression. To meet the given objectives, the project has sought to collect and analyse data from a wide range of sources of different levels of examination. The report also presents observations and recommendations on measures from the micro-level practices to national-level decisions and legislation.

The Lessons from Ukraine project gives an overview of the impacts of modern conventional warfare on the functions of a modern European society and state. It provides a good starting point for independent development and research work carried out by the responsible authorities as well as for the assessment of their activities and development and preparedness work. Although the lessons

learned originate in a country at war, many of its observations and lessons can also be utilised in preparing for other types of emergency conditions. The size of many of the action recommendations produced by the project are equal to entire research or development projects in themselves. The authorities responsible for planning civil defence should, in cooperation with the Defence Forces, chart and prioritise the need for further research and development projects.

6 Conclusions

The Lessons from Ukraine project was commissioned by the Department for Rescue Services of the Ministry of the Interior and executed by the Emergency Services Academy. The project uses Russia's illegal war of aggression against Ukraine as a case for examining the effects of modern conventional warfare on a modern European society and state. Based on this, four objectives were set for the project:

1. How has civil defence been organised during the war in Ukraine?

2. What has been the impact of the war in Ukraine on the civilian population and critical infrastructure?

3. How do the effects of the war in Ukraine differ in different population groups?

4. How are the lessons learned from the war in Ukraine applicable to the organisation and development of civil defence in Finland?

The project has taken an exploratory approach to research. Interview material has been collected for the project from Finnish expert authorities as well as other Finnish and Ukrainian sources familiar with the issue. In addition to the interview material, extensive documentary material consisting of scientific research, research reports, official documents, eyewitness reports and media sources has been compiled for the project from multiple sources.

The data was analysed to compile observations to meet research objectives 1–3. The observations are categorised based on the themes arising from the data. Some key themes can be highlighted. Prolonged conventional war was not anticipated in Ukrainian civil defence planning. To adapt, Ukraine has introduced a number of new measures in, among other areas, outfitting of civil defence shelters and the public alert system. In war conditions, rescuers face numerous new threats to which Ukrainian rescue services have had to adapt. At the beginning of the war, Ukraine was not sufficiently prepared in terms of material and did not start relocating its population in time. During the war, however, Ukraine has been very successful in developing its civil defence.

Ukraine has successfully developed a highly effective system for requesting and receiving foreign aid, with essential cooperation with the EU Civil Protection Mechanism and neighbouring countries. The critical infrastructure of Ukraine has also proven to be highly resilient during the Russian war of attrition. Protecting the production and distribution of public utilities, such as electricity and heat, is practically impossible in modern warfare. However, the resilience to enemy action and recovery of the Ukrainian electricity network in particular has been continuously developed.

Project objective 4 was met by formulating action recommendations for the Finnish authorities based on the project's observations and expert comments. As no in-depth study and comparison of the up-to-date situation of Finnish civil defence with Ukraine has been carried out within the framework of the project, the recommendations are primarily intended as food for thought, to guide new research and development work, and sectoral and national preparedness assessment.

Perhaps the most crucial lesson of the war in Ukraine for Finland is the need to develop capabilities for flexible responses in different threat scenarios. In Ukraine, these scenarios have included the

need to repeatedly use civil defence shelters as part of everyday life and persistent Russian attempts to destroy key civil infrastructure in order to weaken Ukrainian resistance. In Finland, too, the practical measures required by scenarios such as these should be examined.

Ukraine has introduced a number of digital services intended for alerting, guiding and registering civilians. The development of such services for Finland warrants further consideration. Finnish authorities should also study and consider the tactical and technical solutions adopted by the Ukrainian rescue services to protect rescuers and allocate their limited resources. Similarly, measures implemented by Ukraine to safeguard the resilience of critical infrastructure, especially electricity and heat distribution, can be seen as a part of the ongoing work to strengthen crisis resilience in society (see Ministry of the Interior 2024c).

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