

RISK AND RESILIENCE REPORT

Trend Analysis Civil Protection 2030 Uncertainties, Challenges and Opportunities

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Executive Summary

Objective

The nature and impacts of emergencies and disasters vary over time, depending on changes in social, technological and environmental conditions, and the availability of prevention and coping measures. Civil protection is therefore a continuous and dynamic process that requires constant adjustments to ensure responsible authorities are adequately equipped and prepared to mitigate risks and manage potential and actual threats.

In addition to ongoing risk analyses, an important measure for adapting civil protection systems to dynamic societal needs, is periodic analysis of current trends and their likely future impact. The objective of this report is twofold. It aims to provide a systematic analysis of relevant trends for the next five to ten years and to recommend adaptation measures that will optimize the Swiss civil protection system in years to come. The analysis deliberately refrains from ranking the importance of individual trends in order not to anticipate possible strategic decisions. Rather, the analysis is intended to serve as a supportive foundation on which to develop the civil protection system via targeted, coordinated and comprehensible strategic decision-making. It provides a continuation of the first Risk and Resilience Report on trends in civil protection, which was published in 2014, extending the time horizon from 2025 to 2030.

Structure and Method

In the first part of the report, twelve trends are systematically analysed in terms of the uncertainties surrounding their further development, the resulting challenges and opportunities, and possible policy implications for Switzerland. The trends were selected in a deliberative process between the authors and representatives from research coordination and strategy groups of the Swiss Federal Office for Civil Protection (FOCP), and in association with the Labor Spiez. In the second part, interdependencies and issues that were observed across several trends are examined more closely. In conclusion possible further development and adaptation of the civil protection system is laid out. Both parts are based on the analysis of publicly available documents and statistics, and on the results of workshops with representatives of the FOCP and the authors of this study.

Results

Twelve trends are analysed in this report. Pandemics, such as the coronavirus pandemic, are not one of them. However, in some of the trends analysed here, there is a general link to pandemics, which is addressed in the respective sections. Although all of the analysed trends have implications for the Swiss civil protection system, the analysis shows that the scope for civil protection actors to act varies greatly between the individual trends. In most cases, national decisions do not influence trend development, as they are global trends. However, early recognition of these trends and their impact on the Swiss civil protection system, makes it possible to build up the corresponding institutional knowledge, and initiate necessary adaptive measures ahead of time.

Four main fields of action are identified in this report. First, new technologies should be embraced as opportunities. Through the systematic and continuous identification of relevant technological advances and, where appropriate, their gradual integration into existing structures, the Swiss civil protection system can increase its efficiency and adapt its repertoire of capabilities for future needs.

Second, the growing interconnectivity of vital areas, and the resulting increase in complex risk situations, increases the importance of collaboration between relevant actors at all levels. This requires adequate and efficient coordination and cooperation mechanisms, such as joint exercises, to foster exchange of knowledge, experiences, and skills.

Third, growing uncertainty with respect to previously unknown threats and hazards, and their potential effects, should be countered by placing more emphasis on a resilience approach. Both civil society and private sector actors, as well as individual citizens, should be considered critical resources for dealing with uncertainty.

Fourth, a joint and coordinated approach by all components of the civil protection system creates trust even in uncertain times. This has become an essential prerequisite for effective action in recent years, particularly in the field of communication. A continuous dialogue between responsible authorities and the population before a crisis occurs, can establish the trust and awareness needed for a swift and efficient response in an emergency.

Overall, it is important that the Swiss civil protection system does not fixate on the risks arising from the trends, but also recognize and take advantage of new opportunities in non-crisis times, in order to be well prepared for forthcoming challenges.

1 Introduction

Civil protection is a dynamic process that must respond to societal and environmental changes. The authors were made acutely aware of the complexity of such changes when the unfolding coronavirus pandemic led to unprecedented upheavals and changes around the world shortly after the initial analysis of this report was completed. Apart from such far-reaching, historical events, environment and society also face constant incremental changes due to many different factors. These include technological advancements, demographic changes, environmental pressures, climate change, economic growth or austerity, and political shifts, to name but a few. Because civil protection activities and organizations seek to protect the population from a broad range of hazards, a fundamental understanding of societal dynamics is required to effectively adapt the civil protection system to changing needs.

One way to understand societal dynamics is to explore relevant medium- and long-term social, technological and environmental trends, especially with respect to their positive and negative consequences for society and civil protection. Knowing that society changes, insights gained from trend analyses can be used to support strategic decision-making, adaptation and optimization of civil protection systems.

In order to adapt to societal changes and environmental pressures in Switzerland, the Swiss Federal Office for Civil Protection (FOCP) undergoes a cyclical four-year process to understand how change may impact the delivery of civil protection. This trend analysis contributes to the continual evolution of the Swiss civil protection system, as a part of that process.

In particular, this trend analysis focuses on interpreting relevant trends in the context of the policies, practices and organization of the Swiss system. In 2014, the Center for Security Studies at ETH Zürich published the first in this series of trend analysis reports: “Civil Protection Trend Analysis 2025: Opportunities and Challenges in the Areas of the Environment, Technology and Society.” The first edition has been widely used at federal and cantonal government levels as a resource in the development of the Swiss civil protection system. Reflecting the FOCP’s four-year research and development planning cycle, this second edition seeks to support the development of adaptation measures over the coming four years.

The report supplements existing research activities of the FOCP by providing a systematic analysis of medium- and long-term challenges and opportunities for the Swiss civil protection system. It aims to identify adjustments that may be advisable or necessary in order to maintain and optimize the efficiency of civil protection in the years to come. The report is intended as an aide to support decision-making, and it therefore expressly avoids any prioritisation of trends. It describes relevant

trends, uncertainties linked to the possible development of these trends as well as challenges, and opportunities that each of the identified trends presents in relation to civil protection in Switzerland. From this basis, the report discusses potential policy implications required to enable the Swiss civil protection system to respond to the various trends.

The coronavirus pandemic and its aftermath will significantly influence many of the trends described in this report. However, it is too early to understand the full impact, as many questions remain unanswered due to the continual unfolding of the pandemic at present. Nevertheless, all of the trends described will be relevant in the coming years, and it is therefore important that the Swiss civil protection system addresses them proactively.

1.1 Civil Protection in Switzerland

Civil protection in Switzerland is delivered through an integrated system that forms a core component of Swiss security policy. The five partner organizations (fire service, police, health care, technical services, protection and support service) that contribute to the Swiss civil protection system are fundamentally the responsibility of the Cantons. Federal authorities, in contrast, primarily play a supporting and coordinating role. The FOCP defines the principal aspects of the national civil protection system, and coordinates the system at the national level. Federal authorities also bear some operational responsibility, for example, in case of radiological events. In severe emergencies, such as the coronavirus pandemic, private stakeholders and other public institutions, such as the Swiss Army, may be called upon as necessary to support civil protection measures on a subsidiary basis.

The Swiss civil protection system is periodically reviewed and adapted to changing environments. Fundamental reforms were carried out in the early 1990s and between 1999 and 2003. More recent changes include the total revision of the civil protection legislation in 2018, a restructuring of the nation’s command and control and operational communication systems (Polycom), the establishment of an application-based national alerting and warning system (AlertSwiss, from 2014), and the implementation of the National Strategy for Civil Protection and Civil Defense 2015+. The coronavirus pandemic could lead to yet another series of adaptations for the Swiss civil protection system, as the unprecedented situation has provided many hard-won lessons.

Past reforms aimed to bring the civil protection system in line with changes in the national and international security policy environment. The main focus of the system today is on preventive management and damage minimisation in case of disasters and emergencies, and

on strengthening resilience at a societal level. While there is general agreement about the functionality of the current Swiss civil protection system, adjustments will continue to be required in response to environmental, technological and social trends that influence Swiss society and its safety.

1.2 Trend Definition and Selection

In this report, ‘trend’ is used as a descriptor for a social, environmental or technological pattern that is likely to have an impact on the way Swiss civil protection will evolve in the medium- to long-term (5–10 years). The trends create issues that are observable in the present. However, many (if not all) of the challenges and opportunities that the trends pose to civil protection in Switzerland are likely to become more pronounced in the future. The report makes no specific distinction between ‘trends’ or ‘mega-trends’, nor does it rank the importance of these trends.

A central element of this analysis is an assessment of the relevance and implications of each trend to civil protection in Switzerland. In order to simplify the communication of how individual trends influence civil protection, the system’s ability to act, and the current

state of knowledge, illustrations of the three characteristics “impact”, “adaptability” and “knowledge” are provided for each trend. Impact hereby refers to the extent to which Swiss civil protection will be affected by the individual trends, for example, by influencing its operations. Adaptability is the perceived need and ability of Swiss civil protection to address the challenges and opportunities that arise with the respective trends. And knowledge characterizes the knowledge already available within Swiss civil protection regarding the impact of trends and the necessary capacity to adapt. Information presented on these characteristics in the illustrations is based on assessments by experts from the Swiss civil protection community through a short survey.

This trend analysis differs from a traditional risk analysis in two important ways. First, as mentioned, it does not aim to prioritize the importance of particular trends, rather providing information and advice that can be used by others in a decision support manner. Second, by focusing on trends, rather than on risks, it enables a higher-level examination of the issues at hand, including a thorough investigation of opportunities that arise from the trends.

Twelve trends are explored in this report. As should be expected in an open-ended, complex system, all of the trends are interdependent. The chosen trends, and a selection of their connections, are represented in

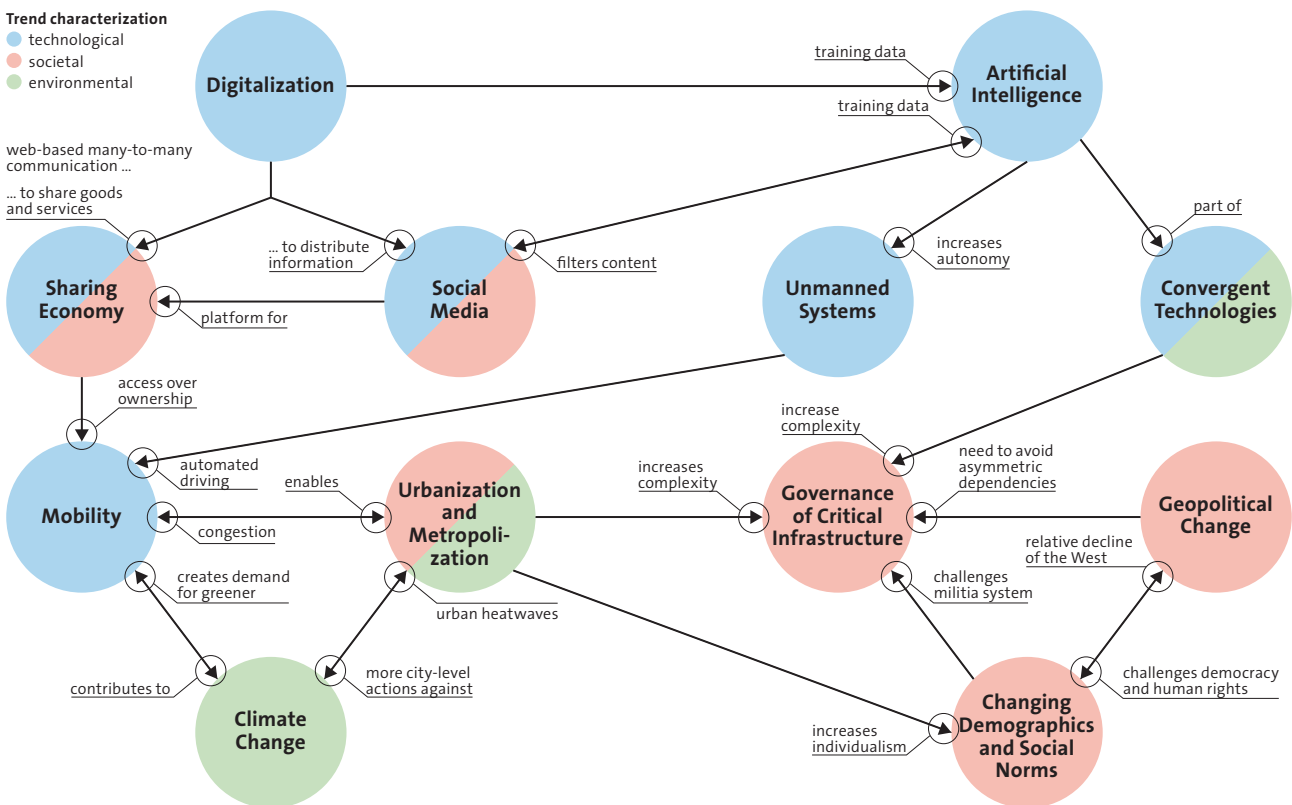


Figure 1: Relevant trends for the Swiss civil protection system in the next 5 to 10 years and examples of their interdependencies. These are to be understood as pinpointing at possible connections between the different trends and do not necessarily represent the major interdependencies.

Figure 1. The concluding section of the report focuses on the importance of interdependencies between trends, and more general associated implications for the Swiss civil protection system.

The selected trends vary in several regards. While some have primarily positive implications for civil protection, others may have negative consequences. Also, the level of uncertainty concerning the nature and the prospects of the trends differs considerably. Finally, both urgent and slow-developing trends are included in the analysis to cover a spectrum of relevant trends. The trends were selected in a deliberative process among the authors and representatives from the FOCP research coordination and strategy groups, and in association with Labor Spiez. The main criterion for choosing them was a foreseeable and considerable impact on civil protection in Switzerland. As such, the technology trends largely focus on the process of digitalization and its impacts. Driven by cheaper access to computing resources, digitalization has already made vast progress in the last decades. Progress ranges from the invention of the World Wide Web, to the spread of social media, e-commerce, cloud services, and the more recent advancements in computer vision, natural language processing, and automated driving. It should be noted that there is a history of overestimating long-term progress in domains with recent breakthroughs – as happened with nuclear power or space exploration in the 1950s and 1960s. Furthermore, there are interesting ongoing developments in a vast variety of fields ranging from synthetic biology, brain-computer-interfaces, additive manufacturing, and plant-based meat, to life prolonging drugs. However, trends often require a certain degree of adoption and maturity to become relevant to, and integrated into, civil protection beyond pilot projects. For example, we included “new media” in 2014 under technological trends. Whereas the novelty of social media as such is starting to wear off, the need to establish and adapt norms, processes, and laws around it will continue as it matures. Hence, in this report we analyse a trend called “social media” and, at least partially, see it as a social trend.

In contrast to the study from 2014, pandemics are not analysed as a separate trend in this report. This is in part due to the findings and results from 2014 still being relevant. For example, the authors of the last report pointed out the fundamental importance of a rapid and coordinated response to successfully contain a pandemic. The situation regarding pandemics has not changed much since 2014, especially when compared to other trends, such as artificial intelligence, which is developing rapidly in terms of technology, and applications. Or compared to geopolitical changes, which were already highly dynamic at global level when the coronavirus pandemic emerged. Or compared to climate change as a trend, where consequences increase to unfold.

As is the case after every crisis, it is important to critically analyse all measures taken during the coronavirus pandemic within the Swiss civil protection system, and to incorporate the lessons learned into future activities. As this adaptation and learning process is still in train at the time of publication of this report, it cannot form part of the present trend analysis. However, many of the trends analysed in this report have some relation to pandemics. For example, artificial intelligence can be used to detect, track, and contain infections. Climate change can be slowed by a pandemic-related economic downturn that reduces emissions from, for example, airplanes and cars due to travel restrictions. Yet, experts also fear rebound effects that can increase the speed of global warming, such as strong economic growth as soon as the pandemic is over, leading to higher CO2 emissions. Pandemics can also serve as a catalyst for ongoing geopolitical changes, either by fostering them or by steering world politics in new directions. Thus, although the focus of this report is not on pandemics per se, the trend chapters touch on the issue where there are relevant implications to consider.

1.3 Report Structure

This introduction is followed by twelve individual sections exploring the trends in alphabetic order. As a reflection of the systematic analytical approach taken, the discussions of the various trends follow the same structure. It starts with general background information on each of the trends to establish a shared basis of understanding. The report then identifies uncertainties associated with each trend, discusses potential challenges, and thematises opportunities they may bring. Each trend analysis is concluded with an examination of the possible policy implications for the civil protection system in Switzerland. Finally, an illustration in each chapter shows how experts from the Swiss civil protection community assess the respective trend in terms of the three characteristics “impact”, “adaptability” and “knowledge”. These assessments are based on a survey, the results of which are presented and compared in full for all twelve trends in Section 14.

The conclusion draws together the issues that either emerged across a number of individual trends or that were found to involve interdependencies between various trends, and thus are particularly relevant for the Swiss civil protection system.

Lastly, the appendices list a selection of essential literature on the various trends for reference and to provide a basis for further in-depth analysis. A summary of the challenges, opportunities, and implications of each trend is also provided.

2 Artificial Intelligence

2.1 Introduction

The development of artificial intelligence (AI) has the potential to alter modern societies drastically. Current AI systems are only capable of achieving goals in the narrow domains in which humans have trained them. However, some machine learning algorithms have started to exhibit weak features of generality – i.e. the capacity to operate across a broader variety of domains. For example, in 2018 the program *AlphaZero* became better than any human or human-programmed software at Chess, Shogi and Go within only hours of iterative self-play, and without being trained on data from human play.

Still, the chasm between current AI systems and human intelligence remains wide. There is no agreement amongst AI researchers in what timeframe human-level artificial intelligence might become a reality. This trend analysis builds on the Big Data trend in the 2014 report, with a considerable update due to the rapid technological developments since then. Because of the uncertainties related to progress in artificial intelligence, this trend focuses on incremental improvements, and application of established machine learning techniques for civil protection.

Machine learning is the subfield of AI that aims to improve performance from experience. Starting from around 2012 there has been an unprecedented boom in machine learning. This is due to a combination of bigger data sets, more computing power and algorithms suited to deal with an enormous amount of intermediate layers between features and outcome variables. This has led to breakthroughs in many areas, including computer vision, language tasks, and strategy games. By 2030, experts expect further breakthroughs in areas such as healthcare analytics, autonomous vehicles, and intelligent tutoring systems.

2.2 Uncertainties

Generally machine learning models require large amounts of data to be reasonably accurate. If the quality and quantity of data on past events, such as disasters, is insufficient, it is difficult to create good predictive models. A model trained on data with few examples relevant to a given case, will be of limited use in forecasting such events. Thus, in the relatively data-poor domain of disaster management, current machine learning models cannot be expected to perform well at predicting emerging risks or low-probability but high-impact risks.

Furthermore, the criteria AI algorithms have to meet can affect the speed of their deployment. For example, the EU General Data Protection Regulation prescribes

the right to be informed about the logic, significance, and envisaged consequences of automated decision-making systems when personal data is processed. Regulating the application of advanced AI technologies will increasingly become a necessity, especially if such tools are used for critical infrastructure operations, or other population-relevant security measures, like tracking and analysing the movement of infected people in a pandemic. This regulatory uncertainty will continue to affect the deployment of AI in civil protection in the medium term (5–10 years).

2.3 Challenges

To benefit from apparent opportunities, AI research and application must overcome several challenges, such as:

- Deep learning models are still largely a black box, whose throughput is not well understood. Accepting decisions or actions that are devoid of human control may hinder the use of such algorithms in civil protection.
- Machine learning models can be purposefully fed with inputs that lead to erroneous predictions and actions by malicious actors. This could have dramatic consequences under circumstances where poor decisions can cost lives.
- Unintentional demographic biases are also a challenge for machine learning. As unchecked algorithms may perpetuate racial or gender biases contained in training sets.
- Civil protection at times deals with rare but catastrophic events that call for new response behaviors, which are not contained in training sets.
- The stockmarket flash-crash in 2010 highlighted how machine-to-machine interaction in decision-making algorithms, with high degrees of autonomy, can lead to unintended cascading effects.
- AI will transform the cybersecurity threat landscape. Future possibilities for cyber-offense include, for example, the automation of social engineering attacks to get credentials and passwords.
- States can use AI for automated surveillance platforms that suppress dissent at unprecedented scale and speed. The realistic fabrications of text, images, video and audio can be used to undermine trust in political structures and the media. Machine learning models can assist the creation of hyper-personalized disinformation, which can influence social agendas and political campaigns.

2.4 Opportunities

AI, and more specifically machine learning, offer many opportunities for civil protection activities. Given the speed of innovation in this field, it is likely that currently unforeseen opportunities will be identified in the coming years. As of today, known opportunities include:

- The viable development of early detection and real-time surveillance of pandemics. In particular, smartphone data can be used for an increasing set of remote diagnostics after disasters. Chatbots or voice assistants can offer multilingualism to rescue teams, and support disaster hotlines in triage and information provision.
- Machine learning models can be used to predict which infrastructures should be inspected, and when inspections should occur. Machine learning can also be used to predict some human behavior, for example, with regards to crime. Applications like predictive policing tools will likely improve, which will make it more applicable to a range of internal security domains.
- Combining machine learning with weather data, flood or landslide forecasting models can be updated daily, hourly or even in real-time, enabling timely location-based safety or impact-based warnings.
- Governments can use machine learning with large amounts of historical data to provide more fine-grained estimates of hazard-specific risks for their annual disaster risk matrices, as well as for more local and short-term assessments.
- Computer vision can make CCTV-cameras smarter, including through license plate recognition, facial recognition, emotion recognition, human action recognition, anomaly detection, and contextual understanding. These capabilities can improve missing persons and fugitive searches, or support first responders' situation awareness in hazardous areas and other types of accidents.
- Machine learning systems can monitor, prioritize and map diverse multimodal data into human-readable formats for crisis managers. For example, they can automatically classify social media content and provide crisis managers with invaluable information about unfolding situations. AI can also be used for advanced predictive and real-time crowd management for mass events like concerts, parades or festivals to avoid mass panicking or other dangerous behavior.

2.5 Policy Implications

Switzerland will need to address the rapid development of AI technology on a regulatory level. Machine learning and automated decision-making algorithms should only be used in high-risk applications if results are explainable and in line with civil liberties. Switzerland could adopt and adapt ideas similar to those in the European Commission's white paper on AI.

Due to a limited pool of machine learning experts and the need for large training sets, civil protection stakeholders might increase their efficiency by creating shared databases with de-identified sensor data and common data reporting standards.

The creation of vulnerability maps, and the modelling of how specific disasters unfold, can often be done locally. Where local civil protection agencies lack such mapping and modelling skills, pilot projects could be initiated in cooperation with academic institutions.

The development and deployment of capabilities related to computer vision and speech are dependent on both the commercial availability and the degree of operationalization within organizations. The earliest adopters of these tools are likely to be the police, border patrols, intelligence services, and airport security. Civil protection agencies could learn from these early-adopters, and shared platforms could be developed for monitoring crises in real time.

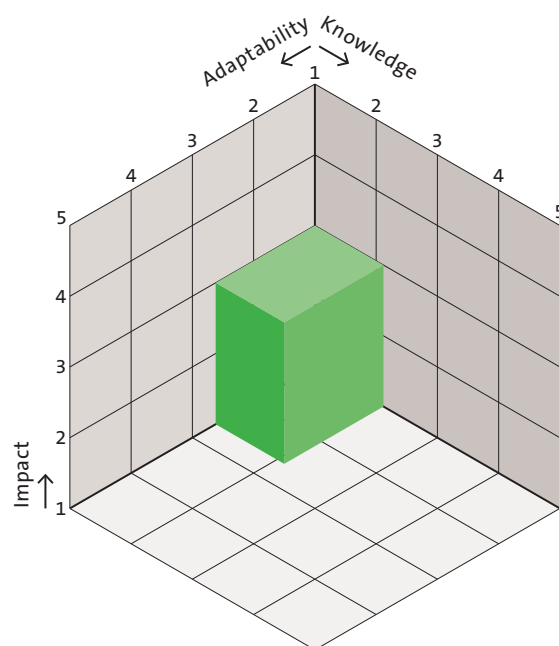


Figure 2: Results of the assessment of the trend Artificial Intelligence with regard to impact, adaptability and knowledge by experts from the Swiss civil protection community

In order to minimize the risks from machine learning algorithms, Switzerland should work towards standards, certification, and insurance schemes that ensure AI systems are developed and tested appropriately. This could include the strengthening of governmental capacity to audit decision-making algorithms used in critical infrastructure. Operational clarity and fail-safes will be prerequisites for critical system redundancies. It is also worth considering under what conditions data and decision-making algorithms, used by private companies who operate critical infrastructure, should be allowed to rely on foreign servers.

3 Changing Demographics and Social Norms

3.1 Introduction

Driven by increasing life expectancies and falling birth rates over recent decades, societies of industrialised countries are ageing across the world. The share of the population in OECD countries that is over 65 years old grew from 7.7 per cent in 1950 to 17.8 per cent in 2010, and is projected to reach around 25 per cent by 2050.

This ageing trend also applies to Switzerland. In 2018, 18.5 per cent of the Swiss population was older than 65 years. The Federal Statistical Office expects this figure to rise to 26–28 per cent by 2050 (depending on the scenario examined). At the same time, today's elderly population is healthier than previous generations, permitting a generally more active life well into the 70s.

The social and economic impacts of ageing societies is somewhat cushioned through migration. In European OECD countries, the increase in foreign-born residents accounted for more than three quarters of the total population increase since 2000. In Switzerland, ca. 25 per cent of today's permanent population is foreign born. This ethnic composition differs significantly in some respects from most other OECD countries, as two thirds of all immigrants living in Switzerland come from EU/EFTA countries. Many of these migrants move temporarily to the country for work, and have little incentive to integrate long-term, or to acquire Swiss citizenship. However, the number of immigrants coming from non-European destinations for other reasons than work, such as refugees or asylum seekers, also increased over the last decades.

As mentioned in the 2014 report, there is strong interaction between the demographic changes described above, and ongoing changes in social norms and values in Switzerland. Time pressure and increased expectations in career, education, leisure time and family, combined with a high level of mobility and urbanization, has resulted in less engagement with traditional volunteer work and local non-profit organizations, as well as less motivation for long-term involvement with volunteer work. This is especially the case among younger generations. Yet, younger generations display no less solidarity than previous generations. Instead, their volunteer work tend to be short-term, issue-driven engagement in looser structures, often based on new digital opportunities like social media.

The current trend in changing demographic and social norms will affect established processes and institutions in civil protection, especially with regard to recruitment, crisis management, and the allocation of resources.

3.2 Uncertainties

The demographic changes to Swiss society is a slow, gradual process influenced by many factors. Therefore, its continuation is uncertain in some cases.

The ageing society trend could slow down in the future due to an increase in the number of younger immigrants to Switzerland. As the experience of Germany between 2013 and 2016 show, a strong influx of preponderantly young refugees led to a temporary decline in the average age of the country.

The trend towards more immigration could also slow down in the future, especially for EU citizens, due to falling demands on the labour market. The proportion of foreign resident in the overall Swiss population could also decline, as a result of policy changes that reduce the requirements for naturalisation in Switzerland. It remains to be seen, what long-term consequences will result from the coronavirus pandemic with respect to migration.

The changes to social norms could slow down due to a return to a greater focus on the local community, for example, at a geopolitical level (see Section 9). However it could also accelerate due to technological progress, or the discrediting of non-profit engagements, for example, due to a major scandal involving a volunteer organization.

3.3 Challenges

The expected trend developments will pose a number of direct challenges to civil protection:

- Elderly people and migrants have the potential to be more vulnerable during crises. They also have additional needs in such situations, for example, in terms of health issues, communication channels, or language. Adapting established emergency procedures to accommodate these vulnerabilities can be a challenge, and might necessitate additional resources in the context of civil protection.
- With more diverse cultures and religions, and a growing difference in lifestyles between generations (e.g. due to technological progress), it can be difficult to develop a common understanding of the responsibilities of the State and individuals respectively. This could have an exacerbating effect on the joint problem-solving skills of militia organizations within the civil protection system.
- An older and, in terms of nationalities, more heterogeneous population can cause personnel shortages in crises, as the pool of eligible and motivated candidates for the militia system shrinks. A lack of under-

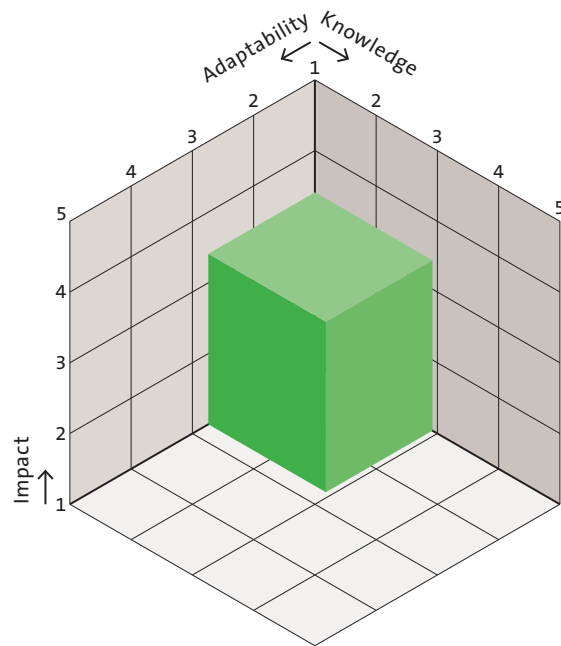


Figure 3: Results of the assessment of the trend Changing Demographics and Social Norms with regard to impact, adaptability and knowledge by experts from the Swiss civil protection community.

standing of the civil protection system or legal requirements may exclude migrants from participating. The absence of age-appropriate functions for elderly people prevents a greater inclusion of this growing group into established structures. The reduced social status of charitable engagement due to changing social norms increases these challenges.

3.4 Opportunities

Despite these challenges, there are also opportunities for civil protection:

- Demographic changes could create a more diverse and potentially larger recruitment pool for the civil protection system. Creating more opportunities and motivational incentives for certain population groups could facilitate their participation. A broader inclusion of elderly people, immigrants, and women will likely increase the resilience of the society as a whole. Their linguistic, cultural, and technological skills, life experience and local knowledge is also likely to benefit the civil protection system. This will of course depend on hazard-specific vulnerabilities, such as a possible higher risk for elderly people in the event of an outbreak of transmissible diseases. At the same time, their integration could improve understanding of group-specific vulnerabilities in crises, and avoid generational, cultural, or gender-based exclusion or misunderstandings.

- The recruitment problems this trend causes for the militia system, offer an opportunity to reflect on the future of the organizational form of the civil protection system. A professionalization of the civil protection system could lead to higher performance and more efficiency, if the necessary resources were allocated. By extending the creditability of community service, more young people could be available for civil protection tasks. For example, compulsory military service could be attenuated or replaced with a general obligation that offers the choice between military service, civil defense, fire brigade, or civilian service.
- Thanks to technological progress, public authorities today have the opportunity to communicate more promptly and directly with the public – before, during and in the aftermath of crises. With the launch of the multilingual and expandable app AlertSwiss in 2018, the FOCP took an important step in this direction. A closer relationship with the public through direct communication, could increase the social status of voluntary engagement by highlighting its importance for civil protection.

In crisis communication, this trend must be taken into account by ensuring equal access to relevant information for all population groups. Today's possibilities for direct communication with the public (see Section 6) could be used more intensively. This could include information about the advantages and mutual benefits of the Swiss militia system that is aimed specifically at currently underrepresented population groups in civil protection, such as younger and ageing people, women, and migrants. Demographic changes must also be embraced by adjusting emergency plans and procedures, especially in urban areas, and allocating resources in a way that is better adapted to the new requirements of a changing population composition.

3.5 Policy Implications

Changing demographic and social norms make it necessary to intensify communication about the importance of the Swiss civil protection system, to adjust certain processes, and to make the militia system more attractive, as well as more accessible, for so far underrepresented population groups.

This trend will likely continue to exacerbate the challenge for many civil protection agencies of finding the necessary personnel. Ways must therefore be found to better account of this challenge, while taking advantage of possible recruitment opportunities presented by demographic changes. This includes more diversity in civil protection personnel composition to better reflect diversity in the broader population. This can be achieved, for example, by opening up the militia system with the creation of more roles in civil protection that are accessible to older people, migrants and, in particular, women, who to date remain an underutilized talent pool.

An attenuated or reduced demand for military service, or changes in admission requirements to civilian service, could likewise help to alleviate the personnel challenges in the civil protection system. More opportunities for ad hoc engagement in loose, event-based roles that do not require much training or previous experience, could motivate more young people to take on civil protection tasks.

4 Climate Change

4.1 Introduction

As highlighted in the 2014 trend analysis, more unstable weather systems are expected worldwide due to climate change. As an Alpine country, Switzerland is particularly affected by the effects of climate change. The temperature increases described in the climate scenarios CH2018 provided by the Swiss National Centre for Climate Services (NCCS), as well as the decrease in snow quantities and duration of snow cover, have a decisive impact on glaciers, permafrost, drought, tree mortality, and thus also on slope stability, erosion, and mass movements, such as landslides and avalanches. Flooding is also likely to worsen due to a predicted increase in the intensity and frequency of extreme precipitation events.

Since 2012, adaptation to climate change in Switzerland has been guided by the CO₂ Act, which strives to reduce CO₂ emissions as a complementary climate protection measure alongside risk mitigation efforts. The Swiss Federal Council is currently proposing that the Confederation and the Cantons should, in future, be jointly responsible for coordinating climate adaptation measures, and provide a basis for these measures.

4.2 Uncertainties

While climate change predictions are marked by uncertainty, there is scientific consensus that climate change will continue to significantly impact environment and society at both global and local levels. Even with broad societal shifts to more sustainable and low-emission lifestyles, the current atmospheric levels of CO₂ will cause significant changes to climatic patterns and extremes in years to come.

How climate change will unfold cannot be predicted with absolute certainty. Yet, it is clear that global warming will continue as a result of CO₂ emissions. Every additional degree of warming will disproportionately increase the risk of weather and climate extremes. The number of degrees with which average temperatures will ultimately increase is dependent on numerous anthropogenic, geological, biological and climatic factors, as well as possible mitigation measures.

The coronavirus pandemic has accentuated these uncertainties and the tangible benefits of mitigative behaviour, as the economic downturn reduced CO₂ emissions and significantly improved air quality in the short-term. Ironically, this could increase the risk of rebound effects longer-term, as financial stimulation packages lead to economic growth and higher CO₂ emissions.

In addition, natural climatic fluctuations can disguise, reduce, or intensify human-induced warming regionally. Without global mitigation measures, the NCCS expects average temperatures in Switzerland to rise faster than the global average in the long-term.

4.3 Challenges

For a densely populated and small country like Switzerland, climate change – and in particular global warming – results in numerous short- and long-term challenges for civil protection:

- The frequency of extreme precipitation events in Switzerland is predicted to increase in all seasons, but especially in winter. This will lead to an increase in flooding, an impairment of slope stability, and more frequent landslides and rockfalls (of various sizes). Particularly in alpine locations, this will impact traffic and tourism as well as the general safety of the population. In the future, winter precipitation will increasingly fall in the form of rain instead of snow in areas below 2000 metres above sea level. This increases the risk of flooding in the Central Plateau.
- Longer periods without precipitation and prolonged heat waves in summer will occur more frequently, especially in lower altitudes and on the southern side of the Alps. Persistent drought lowers the groundwater level and reduces the amount of water available for civil protection activities such as firefighting. More extreme heat will be particularly hard on the elderly and vulnerable people, posing a growing challenge to civil protection agencies serving an ageing population (see Section 12). Higher temperatures also promote the spread of tropical infectious diseases, such as the Zika virus, through new disease carriers, including the non-native tiger mosquito (*Aedes sp.*).
- Global warming increases the probability of large-scale forest fires, even north of the Alps where emergency services have less forest firefighting experience due to fewer incidences in the past. If several forest fires occur at the same time, the resources available to the emergency services in Switzerland will quickly become strained. This scenario requires pre-planning. In combination with extreme precipitation, more forest fires will increase the risk of debris flows, as runoff after rain- and snowfall is more intense on exposed soils. Smoke generated by forest fires near settlements may also cause respiratory issues, such as asthma attacks.

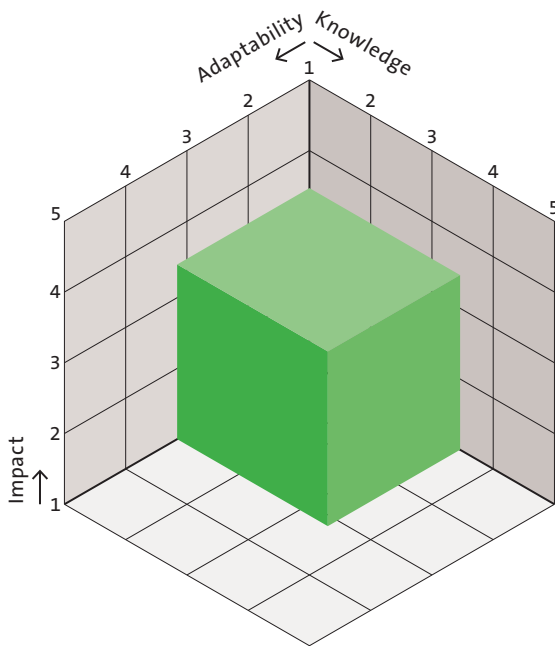


Figure 4: Results of the assessment of the trend Climate Change with regard to impact, adaptability and knowledge by experts from the Swiss civil protection community.

- Numerous infrastructures in Switzerland are located in, or just below, permafrost areas where the impact of climate change are marked. In the Alps, the thawing of permafrost reduces the stability of infrastructures, such as buildings, energy production, tourism facilities, railway lines and roads. Intensive rainfall further reduces soil stability, which exaggerates the effects of thawing permafrost. As a consequence, infrastructures have to be replaced, monitored more regularly, or continuously maintained.

4.4 Opportunities

Research on the causes and effects of climate change has improved significantly in recent years. More comprehensive modelling has increased understanding of processes, and improved the ability to forecast the course of climate change. This makes it possible to develop measures for climate change mitigation and adaptation, which reduce the associated risks.

- The growing availability of reliable information on the consequences of climate change in Switzerland, improves security planning and mitigative activities in civil protection to reduce climate-related natural hazards. Improved forecasting capability also makes it possible to issue weather warnings related to impacts, which will make it easier to plan civil protection operations.

- A number of hazards associated with climate change, such as flooding, have always played a central role in civil protection in Switzerland. As a result, the emergency services already have a high level of flood expertise. For example, flood implications from new climate change threats have rarely occurred in Switzerland, but implications can be observed in other regions. These include thawing permafrost and large-scale forest fires. Learning from other countries hands-on experiences of responding to these threats, can assist the necessary development of local civil protection in Switzerland.
- Climate change can also reduce hazards and provide opportunities. Warmer temperatures can reduce the number of illnesses caused by cold weather. It can reduce the risk of personal injury, traffic incidents, and property damage caused by snow and ice. Less snow in the Alps improves the conditions for the use of solar energy, while potentially longer growing seasons offer the prospect of higher agricultural yields in Switzerland.

4.5 Policy Implications

Climate change affects the work of civil protection in many ways and will require numerous adaptations in the future. Switzerland can benefit from various international efforts, experience abroad, and more intensive cooperation and coordination among national actors.

measures in civil protection, which makes targeted adjustments on the part of authorities a challenge. At an international level, there are three key United Nations processes that link disaster preparedness (the Sendai Framework for Disaster Risk Reduction 2015–2030), with sustainable development (the 2030 Agenda for Sustainable Development) and climate protection (the 2015 Paris Agreement on Climate Change). All three agreements have been ratified by Switzerland, and provide a framework for activities at a national level. Government measures in this area could be improved in Switzerland by promoting more active involvement of the population in precautionary everyday measures.

To encourage people who are responsible for civil protection to look in-depth at the consequences of climate change on their activities, the FOCP and its partners launched the “Civil Protection and Climate Change” project. It aims to build a better understanding of the effects of climate change on civil protection. The results should be used, among other things, to revise existing protection concepts, and to adapt existing structures

Protection and Rescue Planning in Zürich for Heavy Precipitation

The FOCP initiated a project to analyse the relationship between heavy precipitation and operations of “Protection & Rescue Zürich” (PRZ). The project estimated how demands on emergency services will change in the future due to socio-economic developments and climate change. Their analysis showed a quantitative correlation between precipitation and the number of PRZ deployments. It also showed that over the next 20 years, population and settlement trends are likely to pose a greater challenge for PRZ than climate change. However, from 2050 onwards the impact of climate change will increase.

with regards to equipment, training, etc. The results also provide opportunities to improve the protection of the Swiss people via impact-related warnings and targeted deployment of emergency services.

Cooperation between the Swiss authorities is also continuously being improved. For example, the NCCS (founded in 2015) now coordinates climate issues at a federal level, and assists the improvement of cross-sectoral knowledge. As Switzerland has comparatively little experience in dealing with major climate-related natural hazards, it can benefit from international experience in disaster risk reduction. Authorities should therefore participate to a greater extent in the exchange of information on the international stage. This will supplement national measures with increased international cooperation, particularly in the area of individual preparedness and new threats to Switzerland as a result of climate change.

5 Convergent Technologies

5.1 Introduction

Technological convergence describes a process by which traditionally unrelated technologies converge, and become integrated as they advance. The smartphone is an example of technological convergence, which integrates a multitude of traditionally separate technologies (telephone, messaging service, computer, television, radio, camera, etc.). Convergent technologies are evident in the medical sector (e.g. biosensors, drug-eluting devices like stents and pacemakers, etc.) and in the socio-economic sphere (e.g., wearable devices like watches or activity trackers). Convergent technologies are increasingly distorting the traditional boundaries between science, technology, markets, and industries.

Convergent technologies grew out of long-term research and development (R&D) ties between organizations across industries and sectors (private, civil society, government). They are market-driven (not R&D-driven) developments. It is plausible that if civil protection organizations can piggyback on these market-driven adaptations, then civil protection activities would presumably better match the society that drives the market. Because technological convergence combines technologies, effective utilisation requires a new set of management practices.

5.2 Uncertainties

As a result of convergence-inherent dependencies between technologies, and the enabling character of some of these technologies, the development of convergent technology tends to happen in a non-linear fashion, which reduces its predictability. The possibilities for detecting are increased with systematic monitoring of patent databases to track (both positive and negative) convergence. The emergence of convergent technology is ultimately a question of timing.

Convergence is not only important for life science research and health care. It is also critical for future revolutionary advances in many other fields. The opportunities that convergence creates, enables a level of positive uncertainty that surround future adaptations in health, agriculture, industry, culture, environment, defense, etc. In the short term (1–2 years), projecting what is possible can be supported through foresight and patent database monitoring. In the longer-term (5–10 years), it is difficult to anticipate where convergence will develop.

5.3 Challenges

Converging technologies lead to converging challenges. These challenges are observable at different scales, depending on the area. For example, challenges exist with respect to technological safety and security, data security and privacy, ownership of data, etc.

- The convergence of technology is constrained by challenges in education, industry, and government, as well as a shortage of research funding designed to support its unique cross-disciplinary nature.
- The convergence of chemical and biological technologies creates new risks. In particular, how should new bio-chem technologies be controlled, and does their use pose new or unforeseen biosafety or general security issues? This challenge is of central relevance for the Chemical and Biological Weapons Conventions, and Labor Spiez.
- Synthetic biology is a multidisciplinary research area that combines disciplines to create new biological components and systems. An example is Genetically Modified Organisms (GMOs) in the agricultural sector. Here, new technologies allow plants to be modified without being recognized as GMOs, making them difficult to regulate or control.
- Convergence has democratised many aspects of technology. Access to biotechnological developments in synthetic biology, for example, in the digital age has

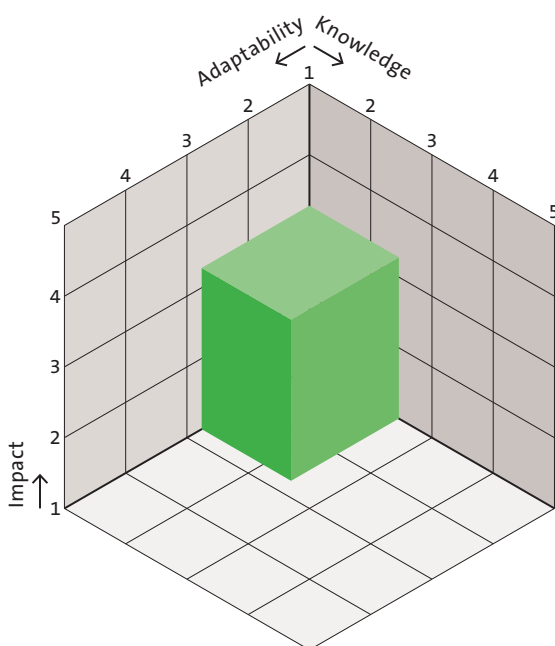


Figure 5: Results of the assessment of the trend Convergent Technologies with regard to impact, adaptability and knowledge by experts from the Swiss civil protection community.

introduced security concerns associated with 'cyber-biosecurity'. These developments add additional security concerns with respect to cross-sectoral internet dependency with respect to the Internet of Things.

- Technological convergence with respect to the personalisation of health care, including data-based treatment (for example, using gene variants from DNA sequencing to discover potential genetically-associated health issues), has significant implications for individual privacy and data security. Much of this data is collected using converging technologies.
- Convergent technologies, like smart meters, can also yield data that is useful in the context of civil protection (including risk assessments and analyses, mapping risks and vulnerabilities, directing protection and security, etc.), as exemplified in the digitalization trend.
- Convergent technologies also create challenges in the context of regulation. To date, governance happens mainly in a siloed fashion with regulation targeted in a strongly disciplinary manner. Because convergence bridges disciplinary gaps, regulation must be adapted to its cross-disciplinary nature.

5.4 Opportunities

In general, convergent technologies provide a variety of opportunities to engage the developmental advances made across disparate fields through efficient new inventions. The combinatory power of modern convergent technologies highlights the potential to find effective solutions to issues that cross existing domains. Convergence of technology can also speed up technological development. In the cross-domain fields of chemistry, biology, and AI, convergent technologies create a range of potential opportunities:

- In the context of pandemics, novel treatments and detection methods become possible. Digital epidemiology may present powerful new means of detecting and tracing epidemics and pandemics. The establishment of integrated preventative (vaccinations), detection (sensors: air/water, wearables/E-health), and treatment (medication) technologies will support the application of digital epidemiology in the short term.
- Synthetic biology is permitting new and faster means of developing vaccinations and other forms of medication (both highly personalized and generic), for

example, to overcome antibiotic resistance. Upcoming convergent technologies (like RNA-based vaccines) might yield substantial improvements with respect to prevention capacities (logistics, cost, flexibility).

- In the context of oversight of critical services, infrastructure could soon be monitored using chemical or biological sensors (microorganisms). Combined with artificial intelligence capacities, these types of sensors will likely increase prediction possibilities for more efficient critical infrastructure protection.
- Other trend analyses in this report discuss opportunities for civil protection associated with specific convergent technologies, like remotely controlled or autonomous systems, social media and ICT, machine learning and artificial intelligence.

5.5 Policy Implications

Since convergent technologies are by definition cross-disciplinary, addressing regulatory issues is particularly pressing for this trend. To this end, expertise has to be spread across different government departments.

Convergence is largely a result of planned long-term development that has linked market demands closely to industrial production. A similar approach that takes a long-term approach to the monitoring of convergence developments, could assist civil protection organizations to gain most practical benefit from these developments. In order to benefit from increasing convergence in technologies, long-term ties should be established among organizations, such as civil protection bodies, who wish to put convergent technologies to good use.

At the moment, different government agencies are responsible for different fields and disciplines. Given that convergent technologies by definition cross disciplines, developing capacities to understand how regulatory questions and problems can be addressed at the governance level should be a priority with respect to this trend. In this context, the Spiez Convergence conference, hosted by the Labor Spiez, entails a promising format that brings a broad range of experts and policy makers together to discuss and share information on convergence in the fields of biology and chemistry.

Managing the cross-disciplinary nature of convergent technologies might also be accomplished by spreading expertise across government departments. Advocating for disciplinary competencies (and specialists) to be spread across departments, could increase the ability of individual departments to understand and manage convergent technologies, as necessary within a depart-

Spiez CONVERGENCE

Spiez CONVERGENCE is a Swiss initiative responding to the challenges that originate in the Chemistry-Biology Convergence of relevance for arms control (CWC/BWC). It provides a platform for international exchange with regard to the technologies and any potential regulations. Among other activities, the project:

- Reviews technological advances with regards to the convergence of Chemistry and Biology, together with the increasing influence by engineering, data science, and AI.
- Invites subject experts to present and discuss developments identified to be of potential relevance for the CWC/BWC.
- Facilitates exchange among a diverse group of experts from academia and industry (from basic to applied research and industrial production state), together with policy experts (arms control).

ment. Concentrating competencies within departments or even departmental sections, will hinder the governance of convergent technologies, and reduce the potential to realize the opportunities this trend may bring in the future.

6 Digitalization

6.1 Introduction

Digitalization is the defining trend of our time. Estimates show that in 2018 worldwide spending on information and communication technologies accounted for more than 3.7 trillion USD. Today, data is an increasingly valuable commodity. Moreover, this trend will continue, with companies that have access to huge quantities of data being positioned at the forefront of our future economy. However, digitalization is not an entirely new trend. Some aspects already influence large parts of our lives, whereas others are only about to emerge – with associated uncertainties.

Digitalization directly or indirectly affects, or is the basis for, many of the trends identified as relevant for civil protection. This includes artificial intelligence, convergent technologies, governance of critical infrastructures, mobility, sharing economy, social media, unmanned systems, and urbanization and metropolization. Aspects of digitalization relevant to these trends are discussed in the respective trend analyses. This trend description focuses more generally on digitalization, especially with respect to the development of “digital twins” (virtual replicas of living or non-living physical entities).

Progress in digital technological development permits ever more design processes to be undertaken virtually. Machines, materials, and medicines are created using digital models and simulations before any physical tests or production commence. The next step in the field of digital prototyping, will be the so-called “digital twin” – exact virtual replications of systems like buildings, cars, or even infrastructures that can be tested and optimized without interfering with the real world. This development is well underway, and it is most probable that this will continue in the next decade.

6.2 Uncertainties

Many of the opportunities that digitalization offers depend on the availability of reliable, high-speed data connections with little latency. To handle the expected massive increase in the amount of data transmitted, mobile network operators plan to implement the next generation 5G data transmission, which aims to reach data rates of up to 10 Gbps. Even more important are the ultra-short latencies of down to 1ms. Problems with the roll out of 5G could severely affect the progress of digitalization in many areas. At the moment, the prospects for Switzerland are quite promising. Still, there are a lot of challenges to overcome in a country like Switzerland with its characteristic mountainous geography.

Climate change is among the biggest challenges humankind faces, and while digital technologies offer possible benefits and solutions to protect the climate, they also pose a huge challenge with the ever-increasing amount of energy needed to fuel digitalization. As an example, take the cryptocurrency Bitcoin. In order to prevent manipulation, the process of generating new Bitcoins is increasingly computationally-intensive. In 2018, the so-called ‘mining’ (solving mathematical puzzles to add blocks to the blockchain) of new Bitcoins accounted for an estimated annual electricity demand of roughly 73 terawatt hours – equivalent to Austria’s average annual electricity consumption. Given the growing awareness of climate change, it is possible that stricter regulation of energy consumption could impact the progress of, or even hinder, digitalization.

6.3 Challenges

Digitalization brings convenience and comfort to everyday tasks, but it also poses considerable challenges for society and the civil protection system:

- Digitalization causes a proliferation of connected devices at all levels of society. These connected devices offer new direct and indirect targets for cyberattacks. The WannaCry ransomware in 2017, for example, affected 200,000 devices in 150 countries. This included computers of the British National Health System, where some hospitals had to redirect patients and reschedule surgeries as a consequence.
- Risks linked to supply chains are a result of most information and communication technology not being built in Western countries. There can be a problem of trust with suppliers of these internet-connected devices. It is difficult to ensure that the hardware has not been equipped with espionage tools or a kill switch during production, or that software is not programmed with backdoors.
- Cyberattacks can influence opinions and seriously increase reputational risk. Attacks do not just target, for example, the break down of big companies’ systems but may seek to steal sensitive and/or valuable data, which can be leaked online. With digitalization, more documents are being saved digitally, increasing the number of potential targets. If information is not securely stored, sensitive and valuable data are at the mercy of attackers.
- Digitalization may also hinder social resilience during disasters. The unique usefulness of digital technologies leads to an ever-increasing reliance on the

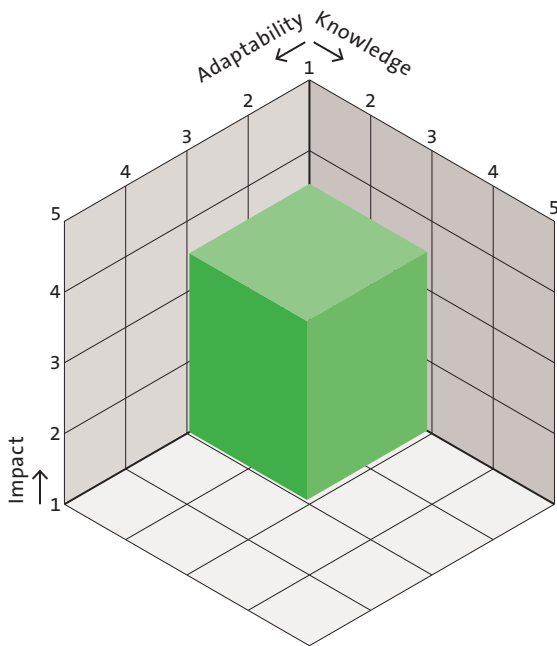


Figure 6: Results of the assessment of the trend Digitalization with regard to impact, adaptability and knowledge by experts from the Swiss civil protection community.

services they offer. The more people become accustomed to the constant availability of digital technologies, the less prepared they may be for a scenario that results in those services or technologies not being available. If people become “analogue alphabets”, they will be less able to deal with those kinds of situations.

- Digital technologies will soon permit the analysis of behavioral patterns, speech, facial expressions and gestures. Automation and miniaturization will bring health testing into Smart Homes. Such data could help to save lives. However, the question remains: are people willing to give up their privacy and data in order to profit from these technologies? This question has become even more pressing with the coronavirus pandemic. Privacy rights, the lack of data protection, the enormous potential for surveilling, and even controlling the population, present major challenges.

6.4 Opportunities

The civil protection system already profits from digitalization on multiple levels. Opportunities include:

- Digital technologies facilitate and/or enable new disaster management, preparation, protection, adaptation, response, and recovery measures. Technologies like unmanned aerial vehicles (UAVs) or digital triaging are increasingly employed in the field. These developments will likely continue to improve.

- Digitalization provides emergency services with huge amounts of data for potential use. Close collaboration between research, civil protection authorities, critical infrastructure operators, and practitioners is central to ensure new digital technologies are adapted towards the specific needs of civil protection.
- A specific example of a technology, which could be used for civil protection purposes is so-called building information modelling (BIM). In BIM, all relevant building data is digitally modeled, combined, and recorded. The specific characteristic of BIM is the combination of the previously separated parts of building design, operation, and maintenance. Access to such advanced and comprehensive models of buildings, could prove to be lifesaving in an emergency. It will provide first responders and disaster relief personnell with a range of previously unavailable or unorganized information, presented in a visual and easy to understand format.
- In disaster scenarios, mobile communication systems can collapse due to overload. Implementing 5G could help to solve this issue. During normal operation, 5G will provide network access to countless devices. Not all of these devices are critical. In crises, they could automatically be switched off and allow the remaining bandwidth to be dedicated to devices that can ensure reliable and stable communication. Similar capabilities already are in place in Switzerland and could be adapted towards 5G networks.

6.5 Policy Implications

Digitalization is everywhere. The trend is so overwhelmingly important that the civil protection system in Switzerland has to address topics like 5G, BIM, cybersecurity, or an overreliance on IT systems in virtually all of its current and future work.

Digitalization will influence parts of society that are specifically designated to serve civil protection purposes, like the system of protective structures that should provide each Swiss citizen with shelter in case of armed conflicts. A digital real time information system would allow responsible personnel to be informed about the remaining capacity of protective shelters, the amount and kind of people already there, and other such factors of interest.

Of course, accessing the benefits digitalization presents, comes with a price tag. A thorough cost-benefit assessment is required. For instance, it could make sense to use BIM more broadly within the Swiss civil protection system. As a first step, the civil protection authorities

should advocate for the introduction of BIM capacity into operational training of disaster relief personnel. Adapting existing BIM solutions to the needs of disaster relief operations, is a task that could, and should, be fulfilled by researchers. Swiss civil protection authorities should provide funding opportunities that support these developments.

With respect to cyber-attacks, it is necessary to develop mitigation strategies and concrete advice for civil society. Large-scale exercises, with a focus on the indirect effects of cyber-attacks, could be an option that engages across sectors (public, private, and civil society). Overall, it is important to keep in mind that digital infrastructures are mainly operated by private companies. Close collaboration between operators and the civil protection system, including the development of new regulating standards for these operators, will be important in the next ten years.

7 Geopolitical Change

7.1 Introduction

The relative economic and military power is shifting from the early industrializing states in the West towards the world's most populous regions in East, South-East, and South Asia. The fast economic growth of China since 1978 has turned it into the world's largest economy when adjusted for purchasing power parity. At the same time, China has violated the US expectations under the Clinton administration that economic liberalization would lead to political liberalization. Instead, the Communist Party of China has solidified its internal control through massive censorship. As a consequence, Washington had a "China reckoning" and great power competition is again the primary focus of U.S. national security since 2018. In contrast, in Beijing the view prevails that the country has bidden its time, and China has become much more assertive in its territorial disputes and its diplomacy. It has also created the "Belt and Road Initiative", a trillion USD infrastructure investment project aimed at linking China with Europe and other global markets, in order to secure friends and resources. Some non-Western countries no longer necessarily link economic development to liberal democracy with human rights and the rule of law.

Under the Trump administration the United States has also put in doubt and in some cases withdrawn from its previous international security commitments. Russia has broken out of the post-Cold War order with the movement of borders by force and new military posturing. Furthermore, regional powers, such as Turkey, may be emboldened by the end of the Pax Americana. These factors have led to increasing discussions about the need for more strategic autonomy in Europe.

Against this background, the question arises how Switzerland might be affected by these developments. Due to its limited resources and size, Switzerland depends heavily on the respect of international norms and institutions. This dependency is further intensified by the country's high degree of embeddedness in international, transboundary networks.

7.2 Uncertainties

First, even though the lense of geopolitics highlights structural factors based on territory and power centers, individual leaders differ in their perceptions of national interests and policy preferences. For example, the Bush Junior and Trump administrations tended to pursue less multilateral actions compared to the Obama administration. Future changes in the leadership of great powers

due to elections or a variety of other factors, add to uncertainty.

Second, the degree of escalation in great power competition is hard to predict. In particular, whether there is room for new arms control treaties, how far the economic and technological decoupling between the United States and China will go and how large the specter of a war between the two superpowers will loom. Conflicts over Taiwan, the South China Sea, and North Korea all have the potential to escalate. However, given the Chinese rhetoric, plans, and manouvers, an invasion of Taiwan might be a scenario of particular concern in the 2020s.

Third, Russia's behavior at its western borders remains a hard-to-predict security concern for Europe. However, Russia is likely to continue to pursue its national interests through the European dependency on its oil and gas, information operations, and the relative military advantage in the region, rather than through norms-based co-operation.

All of these uncertainties, especially the future relationship between China and the US, are further exacerbated by the coronavirus pandemic.

7.3 Challenges

The fractionalizing tendencies in the international system are reflected in states' policy strategies.

- Despite ongoing globalization, a counter-development towards more national and local approaches can be observed. Globally, a pattern of more independent, and less coordinated, foreign policies is emerging, shifting the focus from mutual interdependence to strategic autonomy. This is likely to be reinforced by the coronavirus pandemic. These tendencies are accompanied and exacerbated by the rise of populist nationalist domestic narratives in Europe, the US, and Asia. A lack of financial and human resources, due to a decrease in state-level support, could undermine international organizations' ability to act.
- At the same time, asymmetric and hybrid threats such as terrorism and cyber-attacks continue to add additional layers to the international threat situation. Inherent to these forms of threat is the targeting of civil society and critical infrastructures, where the latter are often owned by the private sector. This pattern is less accentuated in Switzerland, as a considerable proportion of critical infrastructures are still owned by the state. Nonetheless, the potential targeting of civil society and critical infrastructures implies the need to adapt the corresponding threat

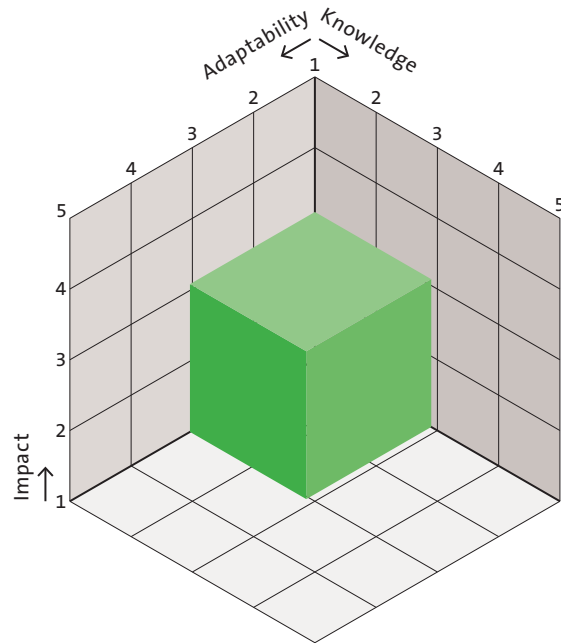


Figure 7: Results of the assessment of the trend Geopolitical Change with regard to impact, adaptability and knowledge by experts from the Swiss civil protection community.

management strategies, in particular civil protection and national defense.

- Supply chains for goods that are relevant to civil protection stretch around the world. In parallel, a concentration of production capacities in a few locations outside of Europe, by a decreasing number of suppliers, can be observed in some key sectors, such as the production of pharmaceuticals. Supply shortages of civil protection-relevant goods in Switzerland can therefore occur outside of conflicts in Europe. This may be caused by unplanned production lapses, or as intended or unintended consequences of conflicts between third parties. The coronavirus pandemic has highlighted the lack of buffers in, and the vulnerabilities of, global supply chains in the face of a sharp, worldwide increase in the demand for certain goods due to an extreme event.

7.4 Opportunities

Notwithstanding the substantive uncertainties and challenges, geopolitical shifts also offer opportunities:

- The tense international context, and rising levels of fragmentation, may come along with an increased demand for mediation and good offices. Capitalizing on the role of an honest broker and impartial mediator represents a major opportunity for Switzerland. The country's position and perception as a trustworthy partner, for instance in the context of the interna-

tionally outstanding role of the Labor Spiez, and its sensitive role in the detection of the use of chemical and biological weapons, is an important international “good office”.

- Further, the emergence of more polarized geopolitical structures creates room for manoeuvre towards more independent foreign policy options and offers potential for new, more regional avenues of transboundary partnership.
- As a consequence of and reaction to the ongoing transitions in the current security situation, an increase in national defense spending becomes more likely. If national defense is conceptualized in an inclusive and holistic manner, incorporating the protection of civil society into national defense framework, for example, then the area of civil protection would gain salience in, and profit from, larger financial contributions.

terms of natural disasters exclusively, but embedded within the larger framework of national security. In this regard, domestic cooperation between state actors on the sub-national level and private stakeholders is crucial.

In addition to an increase in domestic partnerships, also international cooperation becomes more salient as it offers promising avenues to seize opportunities emerging from the increasingly fractionalized international system. Strategic positioning within existing structures as well as the build-up of more regional relations and networks (with the EU and NATO’s existing civil protection and disaster management initiatives, for example) might allow Switzerland’s civil protection activities to benefit in a global system characterised by increasingly polarized constellations. At the same time, transboundary embeddedness should be balanced by maintaining a certain degree of independence and autonomy in critical areas, alongside with the strengthening of resilience and crisis preparedness.

7.5 Policy Implications

The global geopolitical situation was already in a state of flux before the coronavirus pandemic and has only gained dynamism and volatility as a result. In an increasingly fractionalised international system, the timely seizing of opportunities in terms of international cooperations becomes even more important for a small state like Switzerland.

As outlined above, the current global geopolitical situation is dynamic and likely to remain in a state of flux throughout the next decade. Thus, policy instruments and national strategies must generally be able to anticipate and cope with the highly dynamic interplay of challenges and opportunities in the international context. This highlights the necessity to build up and maintain the ability to deploy rapid and flexible responses to both looming and sudden shifts and developments in the global geopolitical setting.

With regard to questions of national domestic security, a possible option is to conceive of civil protection as an integral component of overall national defense, complementing the narrower concept of purely military defense. NATO and its member states are already pursuing their efforts in the direction of civil or total defense concepts. Shifts within the international threat situation (that present relatively distant threats to Switzerland relative to Eastern European areas) underpin the relevance of taking into account the resilience and protection of a country’s civil society as an integral component of national defense. Consequently, civil protection is less defined in

8 Governance of Critical Infrastructure

8.1 Introduction

Critical infrastructures are becoming ever more interconnected and interdependent, complicating their effective governance. The optimal functioning of many infrastructures is dependent on the proper functioning of other infrastructures. Their effective design, construction, maintenance, management, and regulation require adaptations in governance. These interdependencies are striking. A key example is the energy sector that underpins modern society. Another example includes the dependence of modern food supply on logistics and telecommunication systems, sales via the global financial market, fertilizers from the chemical industry, etc. Critical infrastructure personnel must also be able to reach their place of work safely and reliably, and be able to carry out their work without exposing themselves to incalculable risks.

The impact of the restrictive government measures taken to contain the spread of the coronavirus in Europe has exposed the interdependencies between the functioning of critical infrastructures and the wider society. The increasing interconnectedness and interdependencies between critical systems will continue throughout the coming decade. This may result in practical governance challenges, as the need for critical services grows. This is especially the case when ownership of critical infrastructure is mixed (state, private, or both) and subject to varying levels of regulation.

One of the main drivers of critical infrastructure developments is digitalization – or more precisely digitalized control and telecommunication technology. Of all critical infrastructures, the energy sector has long been considered the backbone of modern society. With today's additional dependency on IT, there are now two critical infrastructures on which society as a whole depends. Growing interdependencies and rising complexity make critical systems more vulnerable to systemic failure, as breakdowns or problems in one infrastructure system can lead to cascading failures in other sectors.

8.2 Uncertainties

According to experts, growing systemic dependencies lead to growing systemic vulnerabilities. Nevertheless, large-scale infrastructure failure rarely happens. Even in a crisis as severe as the coronavirus pandemic, services provided by critical infrastructures remained mostly stable and reliable. This pattern might highlight the surrepti-

tious approach of critical systems to critical thresholds or tipping points. Conversely, increasing systemic interdependency may create a positive effect, where complexity counterbalances vulnerabilities through increased redundancy and system flexibility. At present, there is no definite proof for the inevitability of systemic failure due to systemic dependencies.

Formerly, engineers designed infrastructure networks, such as the energy grid, to work for many decades without significant alteration. In contrast, the development cycles of modern IT systems are considerably shorter. IT is used to run and control most infrastructure networks. This raises the question whether the incompatibility between legacy infrastructures and the digitalized systems may cause significant problems in the future.

While technological integration of critical infrastructures continues, the developments in the political sphere are not as clear-cut. The rise of populist and nationalist movements in European countries is a case in point. Interdependent systems call for an integrated governance approach, which is based on an understanding of mutual benefits through cooperation. As soon as disintegration becomes the leading course of action, the chances for successfully governing globalized, networked systems declines.

8.3 Challenges

The trend towards increasing systemic dependencies with respect to infrastructure governance is usually linked to growing risk of systemic failure and systemic vulnerabilities. This poses a set of challenges for the civil protection system:

- The more tightly coupled critical systems become, the higher the probability of a large-scale breakdown leading to catastrophic damage. The mechanism behind this is that of cascading effects, where a small failure in one part of an interdependent system can rapidly cascade through the whole system in unintended and unpredictable ways.
- Infrastructure operators and local policy-makers tend to think and act within their respective system boundaries, often missing the crucial dependencies between systems and related sectors. Even if they acknowledge them in principle, they often do not consider them in their everyday operations because they do not have the necessary knowledge or capacity to manage the logistical, technological, or organizational aspects of the interdependencies.

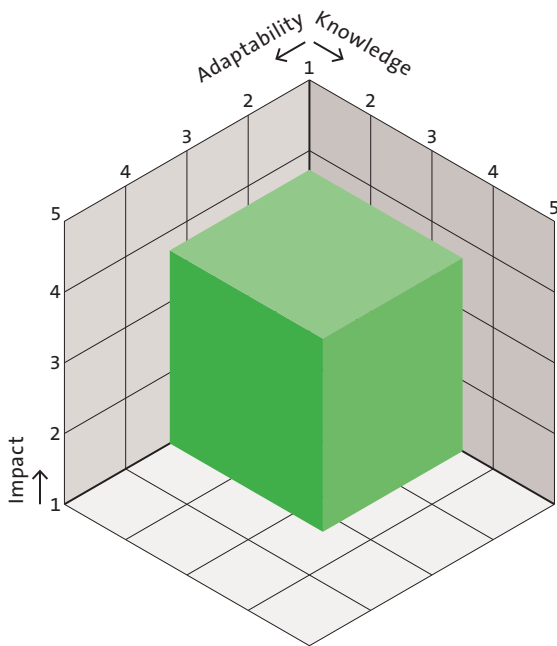


Figure 8: Results of the assessment of the trend Governance of Critical Infrastructure with regard to impact, adaptability and knowledge by experts from the Swiss civil protection community.

- Governing processes for critical infrastructures often follow a sectorial logic. As a result, policy-making and regulation efforts are unable to keep up with growing systemic dependencies, as no one is responsible for managing the “system of systems”. This becomes more problematic when critical infrastructures are separately operated by private companies, as examined in the 2014 trend analysis.
 - International companies that supply Western societies with critical goods and services, be that medical supplies or the set-up of IT infrastructures, may not necessarily share Western values. The power gained through the production of critical devices used in Western critical infrastructures could be used as threat vectors. If supply relies upon companies with monopolized positions, supply chains may also become increasingly brittle, as discussed in the trend on geopolitical change.
 - If different infrastructure sectors use the same or similar IT systems to run their operations, the potential for so called “common cause” failures increases. They share a mutual vulnerability towards directed cyber-attacks that can paralyse the whole system simultaneously.
- Complexity and tight coupling can make systems more resilient. They permit the implementation of principles like decentralization, diversity, and modularization. All of these are well known to increase the resilience of technological and socio-technical systems.
 - In tightly coupled complex systems, advanced digital technologies can also be used to automatically discriminate between different users of critical infrastructure services. Liechtenstein provides a good example, where the introduction of smart meters has made it possible to direct energy flows to the most critical systems in case of an electricity shortage.
 - Using unified or equivalent control systems for different kinds of infrastructure could lead to the emergence of a new type of “all-rounder”, because people could more easily change between the sectors, if different sectors use the same or similar control systems. In doing so, they deepen cross-sectoral knowledge as well as understanding, which in turn increases the organizational resilience of critical systems.
 - Systemic dependencies could lead to “positive cascading effects”, where a small initial trigger leads to widespread systemic improvements. A typical example of this is vaccination, which serves at least two distinct purposes. First, the immune system is highly complex, but with the help of an injection, it can be trained to resist a disease for a long period of time. Second, vaccinating people can protect an entire population from the respective pathogens through “herd” immunity.

8.4 Opportunities

Interdependency and complexity do not serve as ends in themselves. It is rather the multitude of benefits such a structure holds, which led to its emergence. This includes opportunities for civil protection:

8.5 Policy Implications

Systemic dependencies do not stop at borders. They are a global, cross-national phenomenon challenging the resilience of Swiss critical infrastructures. Civil protection should address this in three ways: fostering European coordination, exploring the possibility of insulating critical Swiss systems, and deepening the knowledge about actual interdependencies between sectors.

When it comes to critical infrastructures, Switzerland is part of an international system with close ties to its neighbouring countries. Successfully governing this system is only possible if actors from different countries and sectors work together. Cooperation and coordination are necessary to prevent or manage large scale cascading failures. Thus, civil protection in Switzerland should continue to cooperate with its respective partners from other European countries.

At the same time, Switzerland should look for ways to, at least partly, insulate its critical systems from the larger network in case of an unfolding cascading disruption. Civil protection should invest resources in research and plans for suitable ways to insulate the most important infrastructure sectors in case of a systemic failure for a short period of time. As soon as the systems are back running, insulation does not make much sense, because it is inefficient and makes the Swiss system more vulnerable to local failures as it would be missing ways to counteract this within a broader network.

It is also necessary to know more details about actual interdependencies and the logic behind them. As such, civil protection is not limited to operating in a specific sector or system. Organizations from the civil protection system could possibly serve as moderators or facilitators to bring actors from different sectors together, and create the needed knowledge about interdependency, complexity and the potential consequences of cascading failures within and between Switzerland's most critical systems.

9 Mobility

9.1 Introduction

In the trend analysis published in 2014, the section on mobility focused on several different aspects, including commuting, migration and logistics. This content remains valid. In this edition, we focus on two specific transformations of mobility, namely the development of autonomous vehicles (AV) and electric vehicles (EV). In Switzerland, people travelled a total of 134.6 billion kilometers on land in 2017. This reflects a growth of about 25 per cent compared to 2004. Private passenger vehicles account for about 70 per cent of these kilometres. The development of AVs and EVs will influence society and civil protection considerably in the years ahead.

Conditional automation is already commercially available. Silicon Valley companies and traditional car manufacturers aim to offer cars with high or full automation within the first half of the 2020s. The great promise of AVs is a decrease in human driving errors, with a corresponding decrease in road deaths, accidents and congestion, increased time value while travelling, a reduced demand for central parking space and access-over-ownership models.

Currently, less than 3 per cent of newly registered cars in Switzerland are electric. The Federal Department of Environment, Transport, Energy and Communications aims to increase this share to 15 per cent by 2022. The International Energy Agency expects the share of EVs in European car sales to reach about 50 per cent by 2030 due to high taxes on fossil fuels. Accordingly, carmakers are currently investing heavily into the electrification of their car models.

9.2 Uncertainties

Although AVs and EVs are poised to replace cars with low automation and internal combustion engines (ICE) in the future, there are uncertainties related to their large-scale deployment. In Switzerland, for example, driving AVs on public roads is currently only allowed in trials, which require official authorization. Extensive political, ethical

Electric vehicles after Fukushima

After the Fukushima nuclear disaster in March 2011, the delivery of gasoline to affected regions became a challenge due to inaccessible roads, and the breakdown of oil refineries. In response, Mitsubishi offered 89 i-MiEVs for the recovery efforts, which were crucial in delivering food and medicine to refugee centers.

and legal discussions are required to establish suitable regulation for driving of AVs. In particular, the attribution of responsibility in case of deadly accidents is an obvious issue.

Many countries have accelerated the shift towards EVs through subsidies and increasingly stringent emission standards. A number of countries and cities have even announced phase-out plans that will ban new sales of ICE vehicles. It is not yet clear how support for EVs will continue to increase, and whether political maneuvering will slow down the transition from ICEs to EVs down.

Following price reductions and efficiency gains of battery packs, research and development on battery EVs has significantly reduced range anxiety. While the lack of adequate charging infrastructure, and other technological hurdles regarding energy density and charging speed, will likely be resolved, this may still be an issue hindering wide spread usage of EVs in the near future.

9.3 Challenges

Applying new technologies almost always carries challenges or obstacles that need to be addressed. Autonomous driving and EVs are no different. Looking at general societal impact and civil protection, the following challenges arise:

- AVs strictly follow formal traffic rules. This may be problematic in some circumstances, such as countries with dense and informal traffic patterns.
- AVs constantly scan their environment up to 200 meters in every direction. For fully autonomous cars, the sensory bandwidth will be somewhere between 3 and 40 GBit/s. Further, most cars will have inwards facing cameras. This highlights privacy concerns and high mobile network requirements.
- The possibility of a fleet-wide hack of tens of thousands of vehicles increases the damage potential of a cyber-attack. Tesla CEO Elon Musk named this possibility, as his top cybersecurity concern.
- A switch from private car ownership towards autonomous taxis and ride-sharing will reduce the number of cars in cities. As a consequence, cities might not have sufficient private vehicle capacity to evacuate large numbers of people in an emergency.
- Both EVs and ICEs may be affected by limited fuel sources – sufficient electricity for the former, petrol or diesel for the later. The need to charge many EVs simultaneously, might result in a shortage of electricity in the lead-up to and during large-scale evacuations.

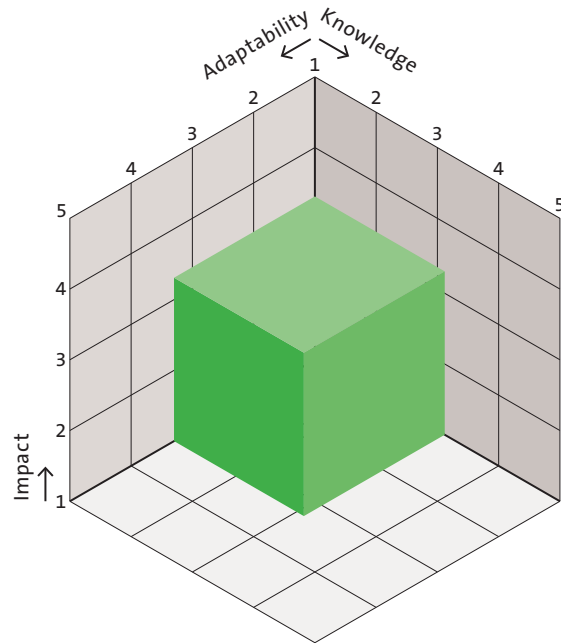


Figure 9: Results of the assessment of the trend Mobility with regard to impact, adaptability and knowledge by experts from the Swiss civil protection community.

In a blackout scenario, there is no electricity at all with consequences for EVs drivers.

- Autonomous cars may be less apt than humans at driving under severe weather conditions, such as heavy storms and flooded streets.

9.4 Opportunities

AVs and EVs offer a range of opportunities for civil protection:

- AVs with Level 3 automation (a driver is necessary, but ‘safety-critical’ functions are deferred to the vehicle) or higher will automatically follow speed limits and spacing requirements. This includes various crash avoidance systems. Hazardous goods transports could demand extra spacing or lower speeds around them.
- The large collective energy storage capacity of EVs can help to make the electricity grid more robust and resilient. Specifically, bidirectional vehicle-to-grid systems can “fill the valley” during times with low energy demand and “shave the peak” by selling energy to the grid when the load is high. Plug-in EVs can also be a valuable resource to bridge electricity gaps between power failures and the restoration of the electricity grid. The car batteries could feed energy back in to emergency power systems, such as communication equipment, traffic lights, or fuel pumps.

- AVs are mobile sensor platforms, looking outwards as well as inwards. Connected vehicles can therefore monitor health signals of passengers. Automated emergency calling could be expanded to more situations. It could transmit information, such as location, hazardous goods, voice, video, and information on transport infrastructure.
- AVs offer point-to-point mobility for evacuations, especially for people who cannot drive themselves. AVs that are not needed to transport people to safety can position themselves to best survive natural hazards. Law enforcement can keep personnel safe by automatically enforcing areas that are restricted to authorized access – for safety and security purposes.
- Vehicles can be weaponized, as shown in recent terrorist attacks in Nice or Berlin. AVs are an opportunity insofar as terrorists cannot simply steer it into a crowd anymore, due to crash avoidance systems, or the ability to override controls externally.

9.5 Policy Implications

The Swiss civil protection system should start to incorporate AVs and EVs into its emergency planning to avoid surprises during disruptive events. (Swiss civil protection survey)

The implications identified in the analysis of broader mobility trends published in 2014 are still valid and should be considered by the civil protection system.

With respect to strategic developments, Switzerland needs to monitor the development and testing of both EVs and AVs in real-life to benefit from their capabilities and address their shortcomings. This includes consideration of how to evacuate people in an emergency if privately owned vehicles are no longer the norm, and the safety possibilities of using AVs during deployments.

10 Sharing Economy

10.1 Introduction

Civil protection agencies at local, regional, and international levels are grappling with effective and efficient resource management, in response to an increasingly challenging hazard landscape shaped by social, technological, environmental and climatic changes. In times of economic stagnation and austerity, authorities are forced to look for smart ways to make the most of scarce financial resources. Human resources have to be employed intelligently, especially in societies facing depopulation and social value changes. Qualified employees are in short supply in many countries and sectors. Resource efficient solutions will have to be developed and implemented by all societal actors and sectors, with expected implications also for civil protection.

In light of the above-mentioned pressures, so-called sharing economy approaches will likely become increasingly important across many sectors. While these approaches differ in many respects, they share a basic principle: valuable resources can be saved through increased collaboration and pooling. The sharing economy is becoming increasingly popular, for example, for accommodation and mobility. This is proliferated by the spread of network technologies that enable decentralized development, production, provision, and use of goods and services, as well as a change in social norms that devalues private ownership. Yet, this trend is not restricted to private consumption. It is also relevant for state actors. Defense politics and actors, such as NATO and the EU, are pushing for interoperability and standardization, which are a key precondition for the pooling of resources.

The concept of a sharing economy aims for common development, procurement, and management of strategic goods and services. This is partly due to increasingly complex and resource-intensive technological systems, which forces many smaller nations to rely on in-

European Civil Protection Pool

In the EU, disaster response is managed through the EU Civil Protection Mechanism's Emergency Response Coordination Centre. The Centre coordinates the deployment of expertise and the delivery of resources, which since 2013 have been registered on a voluntary basis in the European Civil Protection Pool. Based on an internal certification and registration process, the Pool ensures a high standard of resources are ready for deployment at short notice. By September 2020, 25 states had offered 108 specialized response capacities, with 74 meeting the requirements to become Pool capacities.

ternational collaborations for research and innovation. This is already a reality in some fields. For example, nuclear fusion reactors or space laboratories are almost exclusively developed *and* used through international networks. The field of civil protection is expected to turn towards shared development, procurement, management, and use of goods and services, creating new opportunities and challenges.

10.2 Uncertainties

The future success of sharing economy approaches in the context of civil protection and disaster management mainly depends on political willingness and trust. Developing collaborative systems strongly depends on constructive and well-intended relationships between the collaborating partners. If the political climate changes from confidence and cooperation to distrust and competition, the shared use of valuable goods and services is rendered almost impossible. Since political climates tend to change faster than joint projects can prosper (and demonstrate their usefulness), attempts to share resources in politicized contexts is connected with specific uncertainties. For example, the further development of the EU integration process certainly will have a significant impact on the conditions of collaborative activities in Europe as a whole. Developments like the rise of populist parties in many European countries might increase uncertainty with respect to the further development of European integration.

Tight budgets may increase the need to assume pooling and sharing approaches. In contrast, especially in the context of the growing awareness of the consequences of climate change and the coronavirus pandemic, the domain of civil protection could see higher public interest over the coming years. This could lead to more financial resources being made available for this policy field, reducing the need for pooling and sharing.

Other major trends will also place uncertainty on the viability of the sharing economy. Climate change, for example, is inhibiting the ability to fight wildfires in the US West and Australia. 2019 and 2020 have been unprecedented years for wildfires in both countries, which have historically shared fighting resources (equipment and personnel). Being in separate hemispheres has allowed North American resources to be deployed in Australia during the southern hemisphere summer, and vice versa. However, climate change has lengthened the North American fire season, and brought an early start to the Australian fire season, limiting the ability to share resources. This highlights how different trends explored in this report influence each other, with interdependencies causing uncertainty.

10.3 Challenges

While sharing resources may intuitively sound like a logical way to reduce costs and strengthen collaboration between actors and jurisdictions, establishing the necessary structures and processes, involves technical, logistical, and political challenges:

- An effective pooling system demands a high level of standardization from all actors contributing to the system. Only if all elements of a system are harmonized, can resources be jointly deployed without disruptions.
- Developing complex technological systems with many synchronized elements, with several actors contributing specialized capabilities and know-how, sounds promising in theory, but is often hard to implement in practice. A common reason why attempts to build common resource systems fail, is that the technology turns out to be more complex than expected, or that system requirements continue to change after a project has begun. Changing safety and security standards can significantly complicate the development of complex technological systems. Since these are hard to anticipate, and actors have little leverage to change them, this can create significant challenges.
- If shared resources are widely distributed geographically, and have to be transported over long distances before they can be applied, this can cause considerable logistical problems, especially in times of crisis and disaster.
- Sharing resources is often associated with a decrease of redundancies. However, a small resource pool may increase the risk of not having enough resources if a large scale disaster strikes.
- For security-related goods and services in particular, a key question is how to guarantee the availability of pooled or shared resources in times of crisis? This is also referred to as the problem of assured access. Like in every common good situations, actors may have incentives to freeride and benefit from the common pool, while neglecting or concealing their own capabilities. Sharing critical assets therefore preconditions a high level of mutual confidence between all actors.

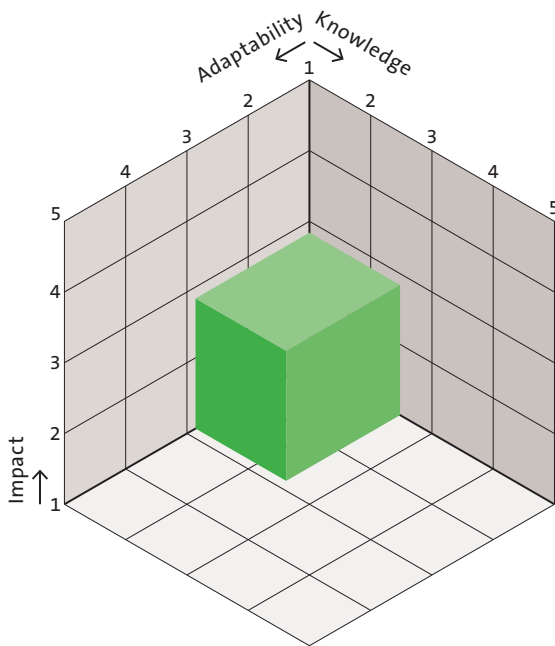


Figure 10: Results of the assessment of the trend Sharing Economy with regard to impact, adaptability and knowledge by experts from the Swiss civil protection community.

10.4 Opportunities

Pooling and sharing of capabilities and assets for civil protection and disaster management, can be beneficial for the participating actors, as it is able to create synergies and free resources for other tasks. Moreover, civil protection at national and international levels can be strengthened through better collaboration:

- Sharing resources can increase the efficiency of civil protection systems, as scarce resources are deployed where and when they are needed. For example, sharing response capabilities between geographical regions with different hazard seasons (e.g., flood or fire seasons) can significantly reduce the time span when well-trained experts, expensive equipment, and other resources are unused.
- Sharing and pooling allow a higher level of specialization among individual actors. Specialized entities can focus on niche fields, while profiting from the expertise of their partners in other domains, and creating synergies. Reliable sharing mechanisms allow for concentrating on the most probable hazards in different regions without sacrificing preparedness for other hazards and black swan events. This leads to increased systemic resilience of the civil protection system overall.
- Joint activities and coordination efforts can be effective ways to increase confidence and trust among actors. This may prove highly valuable when a

major disaster strikes and close cooperation is required. Regular training programs and exercises for staff members are suitable ways to build personal and institutional networks and knowledge.

10.5 Policy Implications

In times of growing cost and resource pressure, and an increasingly challenging hazard landscape, shared economy approaches offer civil protection actors various options for efficient management of the available resources. However, crises affecting many countries simultaneously also set certain limits to the usefulness of such approaches.

Sharing resources and capabilities is particularly logical in countries with small jurisdictions, like Switzerland. Sharing is most attractive for highly specialized and cost-intensive machines and services that are needed on an occasional basis. The Cantons of Zurich and St. Gallen, for example, are sharing capabilities to handle nuclear and biological hazards. Other promising fields, in which to test pooling and sharing in the context of civil protection, are shared research and development activities, such as search and rescue drones, pooled maintenance, or joint training programs. On an international level, there are many fields where, from a Swiss perspective, a strengthened collaboration with neighboring countries and regional institutions, especially the EU and NATO, could result in substantial benefits, and contribute to the overall resilience of the Swiss civil protection system.

11 Social Media

11.1 Background

Social media subsumes a multitude of platforms and networks that allow the direct sharing and distribution of information between users. The rise of social media platforms in recent years, and the continuous spread of the internet, is providing billions of people around the world, the opportunity to directly communicate with each other.

As mentioned in the 2014 report, social media offers numerous applications in the context of civil protection, as it enables authorities to communicate directly with people and to receive feedback. The risks associated with social media have also become increasingly apparent, for example, with the spread of false or misleading information. This can be particularly harmful in a large-scale crisis like the coronavirus pandemic.

The most popular approach to categorize false or misleading information, is to delineate between misinformation and disinformation. While the former is defined as the inadvertent sharing of information that is initially presented as true but later found to be false, the latter is the deliberate spread of information that is false. For the purpose of this trend analysis, two more categories should be considered that regularly complicate public safety responses that involve social media: outdated and insufficient information. Each of these four categories necessitates different strategies to combat their spread.

11.2 Uncertainties

The overall usage and the number of users of social media are growing steadily across all age groups – a development that is likely to accelerate over the next decade. Social media are dynamic, and the preferred platforms frequently change. Organizations using social media must therefore remain flexible, and be aware of the ever-changing usage behavior of relevant target groups.

In light of various data breach scandals, and the misuse of user data by some companies and governments, discussions about data protection and privacy, in the context of social media, have increased in recent years. Such incidents have so far led to temporary declines in the number of social media users, and usually only on the affected platform, without having a lasting effect on the use of social media more generally. Although these issues are likely to continue for the foreseeable future, it is unlikely that they will decisively slow down, or even stop this trend in the long term.

Facebook-Cambridge Analytica data scandal

In March 2018, news broke that *Cambridge Analytica (CA)*, a British political consulting firm, had illicitly harvested personal data from millions of people's *Facebook* profiles. CA supplemented this information with data from other sources, such as demographics, consumer behaviour, internet activities, and other apps to build profiles of individual voters and their political preferences. At least since 2010, the company had used this data to sway the opinion of Social Media users in election campaigns, and to secure votes for the benefit of its customers through targeted political advertising and manipulation. By the time CA's business practices were revealed, the company had impacted the Brexit vote in the UK, the US presidential elections in 2016, as well as elections in countries such as Trinidad and Tobago, Kenya, and India.

11.3 Challenges

The rise of social media creates numerous challenges for civil protection, particularly in the area of mis- and dis-information:

- On social media, information can be shared with a global audience in just a few clicks, without clarity about truthfulness, authorship, or accountability. An organized adversary can use these dynamics for a disinformation campaign to wreak havoc and undermine the fundamental trust in, for example, government institutions. So far, disinformation campaigns have primarily run alongside existing social, political, and economic splits within a target society. Adversarial campaigns could significantly expand on this in the future, and target critical infrastructure sectors, such as energy security, food safety, or public health.
- The use of social media can create an unprecedented spread of communication. This comes with a loss of control over the actual information once it is online, as it can easily be taken out of context, manipulated, or falsified. The participatory nature of social media communication calls into question the quality and reliability of user generated information on these platforms. This poses a particular challenge for civil protection authorities if the population is to be more interactively involved, for example, via crisis mapping where people in an affected area upload information in order to help authorities manage the situation.
- Stakeholders often lack insights into how populations use social media to effectively communicate. Another challenge is the current absence of credible metrics

that can reliably ascertain the impact of an adversarial campaign. For the most part, authorities have focused on generating user trust (increased media literacy, easier access to fact-checking tools, etc.), and extending platform responsibilities (e.g. deleting accounts).

11.4 Opportunities

Compared to traditional communication channels such as mass media, social media offers certain opportunities that civil protection authorities can take advantage of:

- Through social media, civil protection authorities can increase the reach of their communication, and address desired target groups more directly, for example, in a disaster zone. In doing so, the messages conveyed must be “robust” enough not to degrade in value through continued sharing. The information must also be hazard-specific, as each type of disaster entails a unique pattern of social media use. For example, people are more active on Twitter just before a hurricane hits, while activity drops during the actual event. In contrast, when it comes to unexpected hazards, such as flooding, people tweet in real-time to share critical information.
- Unlike most traditional communication channels, social media allows the population to give direct feedback to civil protection authorities. People can express their views, fears, and needs directly to authorities. This could help civil protection organizations to adapt their preparations, and trigger aid deployments in a more targeted manner. This interactivity allows civil protection authorities to obtain locally generated information, that improves their own situational awareness of a crisis.
- Communication via social media is extremely fast, uncomplicated, and can be accessed by many people inside and outside their home. For civil protection authorities, this offers the possibility of informing a large number of people simultaneously, quickly, and on the move, which can help to relieve the burden on emergency call systems. Using social media, civil protection authorities can likewise quickly obtain first-hand information in the event of a crisis – be it through professional emergency services or by involving local residents. This, raises security questions about the trustworthiness of the information supplied and the ability to process it promptly.

11.5 Policy Implications

For civil protection, social media opens up the possibility for interactive forms of communication in addition to traditional ones. This increases the criticality of correct and timely information.

Misinformation and disinformation represent dangers in the context of increased integration of social media into the work of civil protection, which must be countered to enable authorities to reliably carry out their tasks. It is not clear whether public safety agencies should be pro-actively fighting against misinformation and disinformation campaigns on social media. Correcting false information has its value in enhancing and streamlining response effectiveness, but fighting against this information flow might, at times, overlap with the intelligence community and the military’s mission of protecting the nation in the information space. It is also resource intensive. However, if public safety agencies play a role in generating trust in government institutions, then agencies naturally have a frontline role in fighting disinformation campaigns. Having adequate resources, training, staff, and visibility across the information space ought to be the minimum requirement to fulfil this mission. In an extreme event, like the coronavirus pandemic, effective crisis communication that guides people to swiftly follow the advice of the responsible authorities is of crucial importance. For these authorities, countering misinformation and disinformation needs to be a priority.

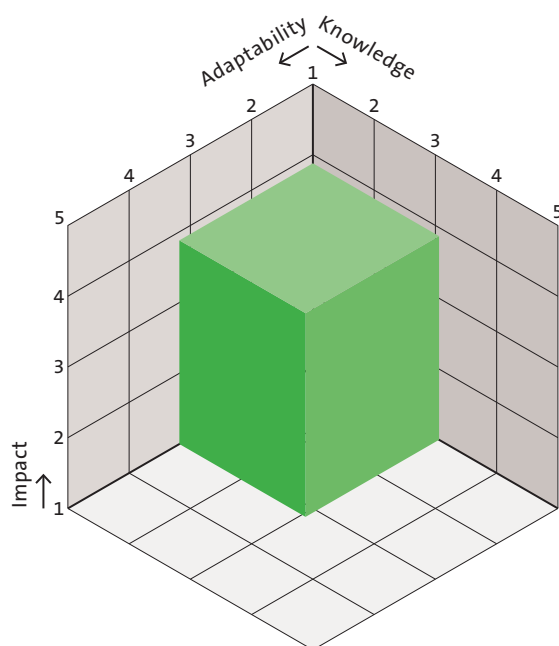


Figure 11: Results of the assessment of the trend Social Media with regard to impact, adaptability and knowledge by experts from the Swiss civil protection community.

Increased integration of social media in communication strategies, opens up new opportunities for civil protection, which should be embraced. For civil protection authorities, the major challenge is to work out when to communicate, with what audience, through which channels, using what messages, and at what pace. Despite their advantages, social media should not replace other forms of communication in the civil protection system (radio, sirens, meeting places, etc.). Rather, social media can act as complementary communication devices that always have traditional forms of communication as a back-up, in case digital communication fails due to power outages or signal failure.

12 Unmanned Systems

12.1 Introduction

The use of drones, or in a more general sense unmanned vehicles, has been a trend in civil protection for several years, and was addressed in the 2014 trend analysis. However, since then new developments have taken place, requiring an update to the original analysis.

The most relevant type of unmanned systems for civil protection are unmanned aerial vehicles (UAV), often referred to as drones, and unmanned ground vehicles (UGV). UAV usually have an advantage when it comes to navigating around obstacles, whereas UGV stand out when it comes to endurance. Thanks to progress in sensors, data availability, and machine-learning, unmanned systems are being developed with increasing levels of automation and enhanced situational awareness, allowing operators to avoid hazardous environments.

The growth in number of simultaneously flying pre-programmed UAV, which evolved from 100 at the beginning of 2016 to more than 2,000 in 2018, demonstrates the increased possibilities associated with UAV. Most consumer UAV already include partial automation, and will likely be capable of high automation by 2030. Militaries already have UAV with high automation capability, including the ability to operate in swarms. They can sense and navigate around obstacles, as well as coordinate joint tactical or even strategic actions through vehicle-to-vehicle communication. Overall, the pace of progress in robot-

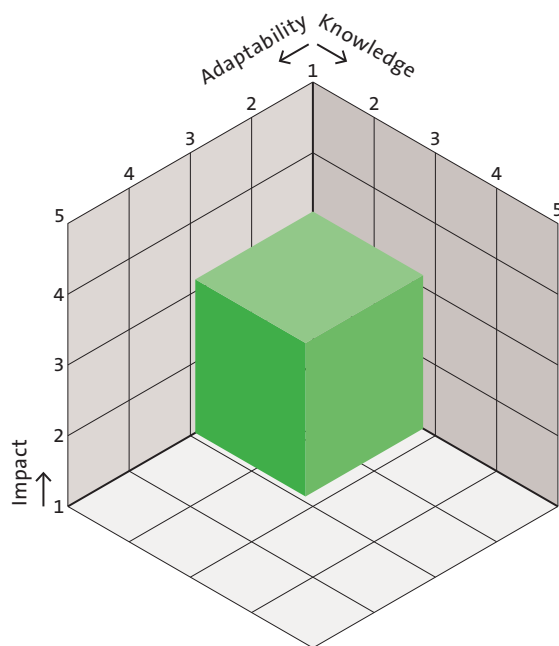


Figure 12: Results of the assessment of the trend Unmanned Systems with regard to impact, adaptability and knowledge by experts from the Swiss civil protection community.

ics is rapid, and will likely trigger increased usage of unmanned automated systems in civil protection.

12.2 Uncertainties

Large-scale deployment and regular use of UAV for civil protection purposes still depends on further development in two areas. First, power supply currently constricts flying machines. The majority of commercial UAV are multirotor with batteries that must be recharged after five to 30 minutes of use. This is insufficient for civil protection operations, where endurance, operability in adverse weather conditions, and goods capacity determine successful deployment. For the near future, most UAV in civil protection will have to rely on fossil fuel-driven technology. Initiatives to address this issue include hydrogen fuel cells, integrated solar panels, land-based power transmission, and automated battery-switching and charging stations.

Second, uncertainty surrounds the question of regulation. In order to integrate a high number of UAV into the airspace, there is a need for a full service unmanned air traffic management regime (U-Space). This includes geofencing and vehicle-to-infrastructure communication around airports and other sensitive structures, tracking and remotely identifying UAV, approving routes as well as rerouting around adverse weather conditions. The Swiss Federal Office of Civil Aviation (FOCA), Skyguide, and other industry stakeholders have set up the Swiss U-Space Implementation (SUSI) process to address this challenge, and provide initial services from 2019 onwards. In comparison, the EU does not envision a full-services regime before 2030.

12.3 Challenges

Since 2014, there has been a rapid development of unmanned vehicles, especially UAV. Nevertheless, challenges remain regarding robustness, cybersecurity, and societal acceptance of the technology:

- Operational search and rescue teams are willing to adopt innovations, but have a strong preference for reliable and tested technologies in high-stress and high-stakes environments. Disasters often go hand-in-hand with degraded communication and extreme weather conditions. Many UAV and UGV applications still do not have the level of technology readiness to perform well under such circumstances.
- In August 2018, a UAV mounted IED was used in an unsuccessful assassination attempt on Venezuelan President Nicolas Maduro. Small amounts of explo-

sives mounted on autonomous microdrones could enable cheap, remote, unaccountable and targeted killing in the future. Similarly, there are proof of concepts for mounting rifles on UAV.

- UAV can interfere in the airspace around airports and thereby force costly shutdowns. Critical infrastructures with a large threat area, such as transformers and overhead power lines, will be hard to defend against a coordinated UAV attack. Unmanned systems easily become extremist tools aiding acts of terrorism.
- High-endurance UAV, with wide-area motion imagery, could provide real-time surveillance of entire cities. Adversarial actors are already using UAV to spy on military, police, prisons, or critical infrastructures in order to monitor and avoid law enforcement, or to collect intelligence on potential targets of terrorism.
- Using UAV to monitor people in public areas, and enforce behaviour via targeted approaching of individuals, as witnessed during the coronavirus pandemic, raises privacy concerns. However, it can also increase coping capacity, as it helps to enforce rule-consistent behaviour.

12.4 Opportunities

The opportunities provided by unmanned vehicles are similar to five years ago. They still have a lot to offer in terms of improved accuracy and detail of available information, intelligence, situational awareness, regular maintenance, and personal safety of relief forces:

- Unmanned systems can improve prevention through early detection and a reduction in human exposure to threats. Mobile sensors mounted on a UAV platform can inspect assets to detect potential risks, thus supporting continuous maintenance operations. The advantages of using UAV in these situations include a reduction in time and cost of carrying out assessments, risk reduction for personnel working in hazardous environments, and opportunities to inspect confined or otherwise inaccessible areas.
- In developing countries, UAV can be used to collect data for vulnerability and risk maps, making them more dynamic and up-to-date. This includes, for example, unplanned settlements, where the ability to map the exact locations of buildings, land use, roads and drainage, or natural features has historically been limited.

- Search and rescue teams could make use of a range of unmanned systems, such as multimodal caged UAV or snake-like ground robots, to roll and/or fly into complex structures to search for signs of life. By 2030 to 2050, swarms of small UAVs will be able to scan impacted areas and buildings with high automation and in a coordinated manner.
- UAV can become a valuable tool for the distribution of relatively lightweight goods, in particular to hard-to-reach locations, such as mountainous terrain or areas with blocked road access. Possible goods include food and water rations, medicine, communication tools, and other hazard-specific tools.

12.5 Policy Implications

Unmanned systems offer a whole range of opportunities for civil protection. Therefore, Switzerland should continue to support both the development of a suitable regulatory framework for their use in civil protection, and the technological development to solve issues, such as a lack of robustness, endurance, and indoor-navigation capacity.

Search and rescue teams need to integrate information from multiple unmanned systems into a unified picture. The capability to integrate and analyse large amounts of data in real-time will serve Switzerland in the future. Structures, such as the National Emergency Operation Center (NEOC), should be organised to support such activities. In order to deploy UAs without losing public trust or violating privacy laws, transparent national standard operating procedures should be developed in accordance with the Swiss Federal Data Protection and Information Commissioner.

The development of a comprehensive U-Space regime must continue. The FOCP can ensure that disaster communication concerns remain a part of this process. For infrastructure inspections, commercial off-the-shelf UAV, whose routes can be pre-programmed, should suffice in most instances. To further develop the use of UAV and UGV in disaster response, collaborations between universities and operational teams can assess technological and practical readiness levels in simulated disaster environments, particularly in the areas flagged as opportunities above.

13 Urbanization and Metropolization

13.1 Introduction

Urbanization is commonly understood as the process by which more and more people live and work in cities instead of regional and rural areas, with cities expanding as a result. This has become one of the key trends of the 21st century, with more than 50 per cent of the human population now living in cities. Metropolization describes the process by which several already urbanised spaces expand and merge to form a metropolis. The transitions from one to the other are fluid. By 2030, five billion people are predicted to live in metropolised urban centres. While this growth will primarily take place in Asia and Africa, in Europe 73 per cent currently lives in urban areas – a figure that is expected to grow to over 80 per cent by 2050. Other estimates suggest that in some European countries, up to 90 per cent of the population will become urbanised.

Urbanization is a Europe-wide trend. In Switzerland, 74 per cent of the population now lives in or around urban areas. Like in other parts of Europe, these spaces are continuously metropolising, with population densities in both cities and the surrounding regions growing every year. The conurbations of Switzerland's densely populated midlands is increasingly linking the Alps to the south and the Jura Range to the west.

Such growth and changes in the concentration of people, goods, and services, impact land planning and urban development. Rapid urbanization requires rapid construction of urban infrastructure. These changes can shift the risk exposure of the population. The complexity and interdependency of critical infrastructure networks in urbanizing regions may increase their vulnerability to disturbances. To date, however, this mix of complexity and interdependency has increased the robustness of these networks. Nevertheless, if land planners and regulators do not adapt to, and acknowledge changing hazards and urban development trends, more people may live at risk in the future.

Unmanned Firefighters

The European research project TRADR examined long-term human-robot teaming for disaster response. It teamed a heterogeneous fleet of UGV and UAV with firefighting crews to generate precise 3D maps of inaccessible indoor environments, and to localize potential casualties. Firefighting crews already use UAV, such as the Fotokite from the ETH spin-off *Perspective Robotics*, to gain aerial perspectives and thermal video.

Cities have developed into the most economically productive places in many countries. This development has been supported by complex interconnected infrastructure, good education systems, and the fact that cities are the focal nodes of connectivity that bind the global community together. The expansion of urban areas as centres of production has climate change implications. Approximately three quarters of all energy use and CO₂ emissions have been attributed to urban areas. Given their production and population density, cities should be the points of focus in the development of 'green' or 'smart' cities to ensure sustainability of development and urbanization.

13.2 Uncertainties

Given the diversity and complexity of urban areas, how cities govern a future characterized by uncertainty associated with, for example, climate change, financial crises, armed conflict, political instability, infrastructure complexity and privatisation, natural hazards, or disease outbreaks will vary between cities, regions, and nations.

Uncertainty is not evenly distributed. Different urban actors apply different resources, tactics, and techniques to cope with specific elements of uncertainty. Vulnerable members of the Swiss population will experience different forms of urban uncertainty (for example, housing uncertainty in the face of urban gentrification) than other members (for example, decreasing efficiency of public transport). As such, developing a generic approach to understanding and addressing uncertainty in urban environments in a comprehensive manner is challenging.

13.3 Challenges

In the context of civil protection, the concentration of people, industry, and infrastructure in metropolitan areas is likely to result in more complex disasters, due to the interconnected nature of modern cities.

- Growing urban populations can impact the efficiency of critical infrastructures – putting additional pressure on public transport and roads, telecommunication networks, etc. For example, technical failures resulting from overloaded systems can lead to electricity outages that have cascading and costly effects, including blackouts.
- Rising temperatures from a changing climate could create challenges, for example, for the electrical grid with increased demand for electricity to cool homes and offices. The CSS mapped social vulnerability in the context of urban heatwaves in Zürich, finding vulnerable populations, such as the elderly, to be disproportionately impacted by the health consequences of heatwaves. Climatic projections for Switzerland suggest that summer heatwaves will be longer and more intense in future, especially in the lowlands.
- Poorly managed urbanization, which fails to consider the changing risk environment and the risk exposure to city inhabitants (for example, with respect to climate change), may place communities in areas that are prone to flooding, avalanche, mudslides, and rock-falls.
- Many people living in densely populated cities could lead to more rapid growth and spread of infectious diseases, such as the coronavirus.
- Evacuation of urban populations will significantly impact surrounding communities, who may feel overwhelmed socially and economically by the influx of large numbers of people in the case of extreme events.
- The continuing growth of urban areas and increasing requirement and importance of mobility make the coordination of settlement and transport more difficult, especially during crisis responses.
- Demographic change and developments in the housing market (gentrification, for example) are placing pressure on Switzerland's existing levels of social cohesion. Research highlights the importance of social cohesion in community responses to crises.
- As cities become more complex, more populous, and more important for national economies and production, the need to organise and develop cities in a sustainable (environment, social, economic) and well-managed fashion becomes more important. (data offers a means of informing planning and development processes)
- Sustainable urbanization requires coherence between human (social and human capital, access to mobility options), technological (yielding quality of life, and supporting competitiveness) and institutional factors (participatory governance and well-managed infrastructure).

13.4 Opportunities

The growth of metropolitan areas and the impact of growth on land planning actions and regulation is a relatively slow moving trend, permitting opportunities for civil protection to adapt and prepare for future challenges.

- Availability of data could offer the chance to engage in better 'informed urbanization'. Large data sources already available today (drawn from sensors in infrastructure, smart metres, etc.) could be used to plan networks and flows in cities with respect to housing, transport, migration, resources, etc.
- Notably this is a cross-cutting trend that creates an opportunity for more collaboration across administrations and sectors, as well as to enhance resilience by engaging in land planning issues that aim to mitigate risks – both technical (infrastructure complexity and interdependency) and societal (social vulnerability because of changed exposure).
- In more densely populated areas, land-planning and risk management considerations should be paired with an assessment of the population's capacity to respond to change or emergencies. While urban populations may be less self-sufficient in the context of preparedness than rural populations, for example, they may have access to more resources that could offset such preparedness deficiencies.

13.5 Policy Implications

The rapid intensification of urban infrastructure highlights the need to develop complementary approaches to critical infrastructure protection, including the use of available data on function, maintenance, and failure.

Developing responsive processes to deal with urbanization and metropolization in the context of hazards that might impact cities and regions, will influence both land-use planning and civil protection in the future. To fully understand the breadth of the changes underway, hazard mapping exercises should be linked between federal and cantonal levels in Switzerland, which would enhance coordination, improve transparency, and possibly lead to creative, holistic solutions. Emergency managers should periodically reassess population movements and adapt evacuation procedures and routes accordingly. Risk and safety analyses and risk communication processes must be incorporated directly into the broader land-use planning processes, and across administrative boundaries, given the trend towards metropolization. This includes ensuring that risk management and assessment processes for critical infrastructures consider changing conditions that can shift risk exposure, particularly for vulnerable populations.

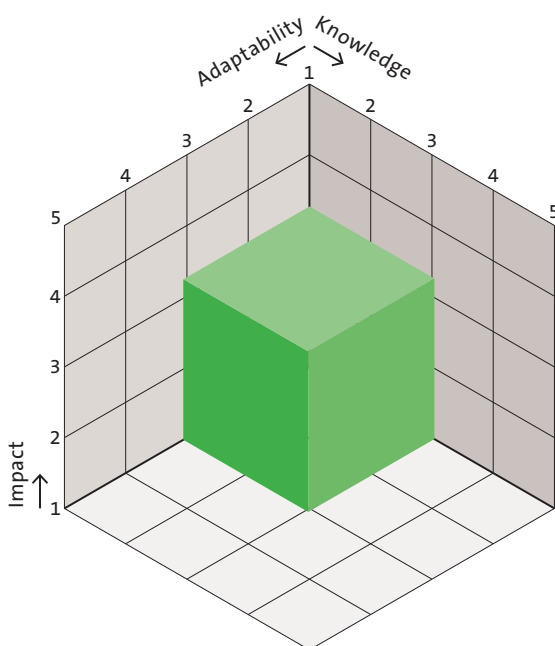


Figure 13: Results of the assessment of the trend Urbanization and Metropolization with regard to impact, adaptability and knowledge by experts from the Swiss civil protection community.

14 Overview: Impact, Adaptability, Knowledge

A central part of this trend analysis is to assess the relevance and implications of each trend to Swiss civil protection. In order to assess the impact, adaptability, and state of knowledge of Swiss civil protection, a short survey was conducted with experts, in addition to an analysis of academic and practice-oriented literature. The summary results of the expert survey for each individual trend are presented graphically in the respective chapters. In this section, the results are briefly discussed across the trends. Further implications of the general findings of this analysis, and concrete proposals for action, are discussed in the concluding section.

14.1 Impact

Impact refers to the extent to which Swiss civil protection will be affected by the individual trends, for example, by influencing its operations. According to the experts surveyed, Swiss civil protection is impacted by the majority of the trends analysed. There is no clear differentiation of trends between the areas of technology, society, and the environment. The experts believe that Swiss civil protection in the coming years will be most strongly impacted by the two trends Social Media and Governance of Critical Infrastructure. This is followed by Digitalization, Climate Change, Changing Demographics and Social Norms. Other technological trends, such as Mobility, Convergent Technologies, and Unmanned Systems are considered by the experts to be comparatively less influential in the Swiss context. The experts also consider Geopolitical Change and developments in the field of Artificial Intelligence will have limited impact on Swiss civil protection during the next ten years. This perception is somewhat surprising given the high dynamics in both areas. The trend Sharing Economy was rated as having the least relevance, which might be due to this topic only gaining prominence in the field of civil protection in recent years.

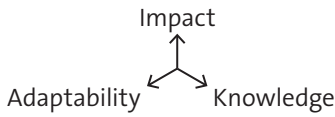
14.2 Adaptability

Adaptability refers to the perceived need and ability of Swiss civil protection to address the challenges and opportunities that arise with the respective trends. On average, the experts surveyed assess the adaptability to the trends to be fundamentally lower than the degree to which they potentially impact the Swiss civil protection system. There is no clear differentiation between the

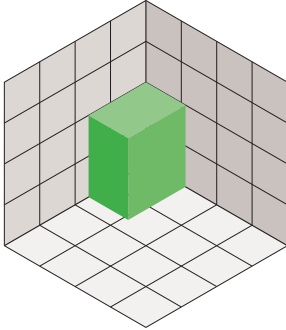
technological, social, and environmental trends. However, the overall dispersion of values is generally smaller than is the case for impact. The experts see the greatest need for adaptability with the trends Mobility, Governance of Critical Infrastructure, Social Media, and Climate Change, which correlates with the high degree of impact of these trends on Swiss civil protection. These particular trends have also been the subject of some discussion in Switzerland in recent years. Next are trends such as Urbanization and Metropolization, Geopolitical Change, and Digitalization, where the experts consider Swiss civil protection to have a moderate chance of coping with the resulting challenges and seize opportunities. The trends Convergent Technologies, Changing Demographics and Social Norms, and Artificial Intelligence are considered to require least adaptation. This correlates with a perceived low impact of the Artificial Intelligence trend.

14.3 Knowledge

Knowledge refers to the knowledge already available within Swiss civil protection regarding the impact of trends and the necessary capacity to adapt. According to the experts, the differences in existing knowledge with regards to the individual trends are more pronounced than the differences for impact and adaptability. Again, there is no discernible pattern between trends in technology, society, and the environment. Existing knowledge is considered greatest for the two trends Governance of Critical Infrastructure and Climate Change. Both trends have been the subject of discussion and concrete projects in Swiss civil protection in recent years. They have also been a prominent topic of public discourse in Switzerland. These two trends are followed with a considerable gap by Mobility, Social Media, Urbanization and Metropolization – three trends that received relatively high scores in terms of impact and adaptability. They are judged to impact Swiss civil protection relatively strongly, and a high level of knowledge is already available to meet the challenges and opportunities arising from these trends. Less knowledge appear to exist among the relevant authorities concerning Digitalization, Changing Demographics and Social Norms, Geopolitical Change, and Unmanned Systems. According to the experts, there is also room for improvement in Swiss civil protection with regard to acquiring the necessary institutional knowledge and capacities to address the trends Sharing Economy and Convergent Technologies. The same goes for Artificial Intelligence – the trend to which the experts attest least existing knowledge. This may change in the aftermath of the coronavirus pandemic, as this trend offers new opportunities for the control of pandemics.

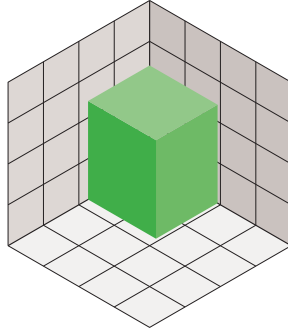


Artificial Intelligence



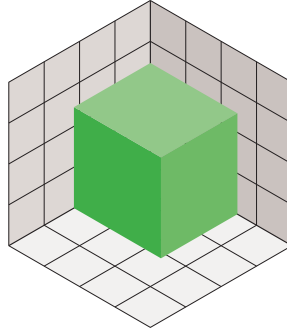
Impact: 3.00
 Knowledge: 2.12
 Adaptability: 2.62

Changing Demographics and Social Norms



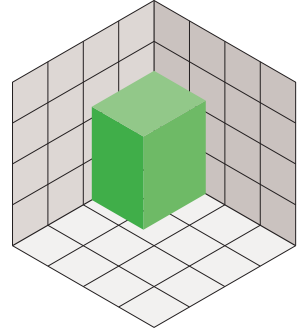
Impact: 3.41
 Knowledge: 2.92
 Adaptability: 2.74

Climate Change



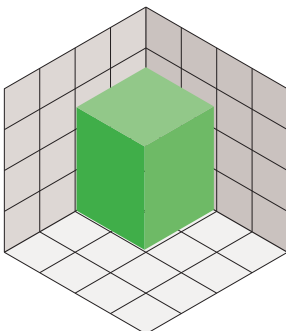
Impact: 3.47
 Knowledge: 3.46
 Adaptability: 3.16

Convergent Technologies



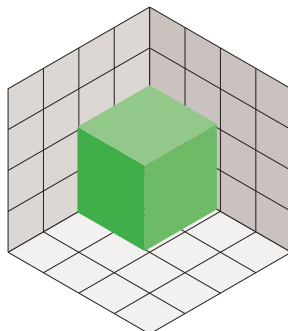
Impact: 3.28
 Knowledge: 2.46
 Adaptability: 2.76

Digitalization



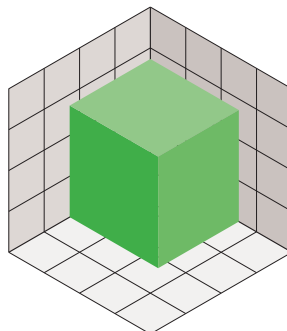
Impact: 3.53
 Knowledge: 2.92
 Adaptability: 2.96

Geopolitical Change



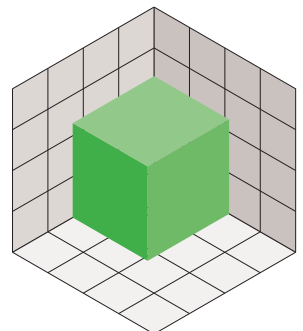
Impact: 3.09
 Knowledge: 2.90
 Adaptability: 3.04

Governance of Critical Infrastructure



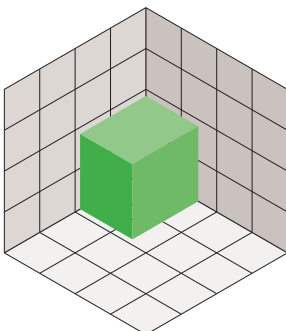
Impact: 3.73
 Knowledge: 3.50
 Adaptability: 3.28

Mobility



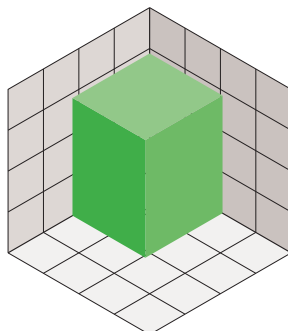
Impact: 3.31
 Knowledge: 3.12
 Adaptability: 3.30

Sharing Economy



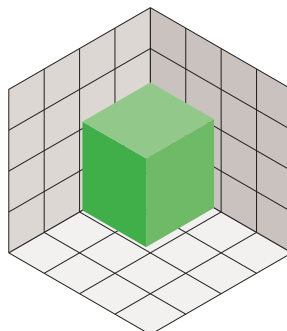
Impact: 2.84
 Knowledge: 2.48
 Adaptability: 2.86

Social Media



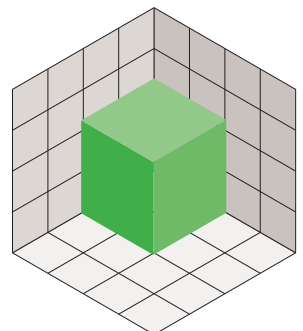
Impact: 3.88
 Knowledge: 3.06
 Adaptability: 3.18

Unmanned Systems



Impact: 3.17
 Knowledge: 2.80
 Adaptability: 2.92

Urbanization and Metropolization



Impact: 3.27
 Knowledge: 3.04
 Adaptability: 3.06

Figure 14: Overview of all results of the trend assessment with regard to impact, adaptability and knowledge by experts from the Swiss civil protection community.

15 Conclusion

When compared with the 2014 report, many of the trends identified then have continued and often become more accentuated. It is therefore not surprising that many of the key findings of the 2014 report still hold true. Some trends have even become more pertinent, such as the findings related to pandemics. Since 2014, new trends have also emerged, while the impact and relevance of certain existing trends for civil protection have shifted due to new developments. In the following, the most important cross-trend findings between the current and the 2014 analyses are discussed. The focus here is on possible implications for the processes, structures, and capabilities of Swiss civil protection in terms of its future development.

15.1 Technology as opportunity

The last two decades have been characterised by ever faster technological progress, leading to fundamental changes in almost all areas of life. Technological developments, such as progressive digitalization or the internet, are changing human behavioural patterns, for example in communication. They are also opening up new industrial fields, while revolutionising existing ones. Today, the speed of technological progress is so fast, and the associated new opportunities are so varied and extensive, that established institutions and services often find it difficult to keep pace with changes and opportunities. The reasons for this are manifold. Often the advantages the new technological possibilities bring are not recognized, or are not considered to be sufficiently beneficial to adopt, because services could be reliably provided without them in the past. High initial costs, lack of expertise and experience in the existing structures, or an unclear regulatory environment, may also prevent the application of new technologies. In addition, emerging technologies often bring new challenges and risks that can lead to a discontinuation of their use. Consequently, civil protection systems worldwide use historically proven structures and tools. Although civil protection organizations have improved in recent years in their ability to better adapt to the potential of new technological developments, there is still room for improvement.

Seize new technological possibilities

As highlighted in the respective section, the technology-related trends identified in this analysis, such as artificial intelligence, unmanned systems, and digitalization, have numerous potential applications in the Swiss civil protection system. Increasing the use of new technological possibilities, such as databases and information systems that are updated remotely in real time, using sensor data or

the like, could offer potentially large gains in terms of cost and resource efficiency and effectiveness. It could also give civil protection new capabilities, such as the large-scale use of UGV to evacuate at-risk areas. However, Swiss civil protection is a large, widely ramified structure in which many people with different levels and types of expertise and time commitments work together. Many of the new technological possibilities require a relatively high level of specialised knowledge and training for their effective application. Thanks to the militia system, the Swiss civil protection system is comparatively well placed to take advantage of existing expertise from the private sector. However, a sharp increase in the use of new technologies would likely require a higher degree of professionalization and associated reorganization. The existing, well-established structures in Switzerland should be given sufficient time to first identify, and then sensibly integrate, any new technology and capability in order to maximise their usefulness for civil protection. Adjustments would have to be understood as one step in a continuous and gradual process. In order to avoid being overtaken by rapid technological progress, dedicated structures and processes are needed to monitor technological developments on an ongoing basis.

Regulatory clarity creates certainty

Due to the speed of technological progress, legislation and regulation in Switzerland are often lagging behind in relevant areas. A persistently unclear regulatory environment hinders innovative approaches, and makes the timely and targeted application of new technologies more difficult. Civil protection is also an area where commercial, off-the-shelf resources and solutions have to be developed and deployed to meet specific requirements. Uncertainty as to whether and how cutting-edge technologies can be used, and existing operational protocols and standards adapted, is a deterrent to innovative approaches in civil protection. More clarity in legislation and regulation would help civil protection authorities to assess how new technologies can be used in practice. Appropriate legislation and regulation also allow risks and challenges associated with the application of new technologies to be addressed.

15.2 Growing complexity as challenge

Modern societies, like Switzerland, are dependent on the uninterrupted functioning of critical infrastructures, such as energy supply and telecommunications, which in turn depend on other infrastructures for their functioning. Trends, such as mobility and digitalization, influence and intensify existing logistical and technical interconnec-

tions, while also creating a multitude of new interdependencies. This growing interconnectedness multiplies the damage potential of existing and emerging risks. It also increases the complexity of societal systems in general, which can have positive as well as severely negative impacts, such as the susceptibility to disruption in case of damaging events. In the context of civil protection, there are various possible approaches to better deal with the ever-increasing complexity of today's world.

Increasing interdependencies and new risks

The trends described in this analysis are accompanied by technological, environmental, and social developments that affect each other. The effects of trends, such as social media or climate change, have been accentuated since 2014. This has increased the potential positive and negative impacts of interdependencies, making their consideration all the more important. New potential risks must be clearly identified and, if necessary, counteracted with appropriate measures. More interconnectedness also aggravates existing risks, for example, through a greater dependence of the population on the functioning of new technologies. Possible interactions and cascading effects must therefore be taken into account to mitigate the systemic impacts of possible risks. Civil protection should be understood as a comprehensive task involving all sectors of society. To achieve this, the exchange of knowledge between experts and policy makers from all relevant areas should be further promoted. More training exercises involving vital sectors of the economy and civil society could also be useful for early identification of weaknesses. In an increasingly complex world, it is also important to future-proof for new potential disasters, for example, by building up capacity in the field of horizon scanning.

Learning from others

Learning from other countries' experiences of trends – the impacts and needed adaptability – can be instructive for the targeted development of civil protection in Switzerland. Given the complexity of the impacts, the continuing acceleration of technological progress, and the growing efficiency pressure, such lessons will likely grow in relevance in the future. In the field of technological, exchanging knowledge with partner organizations in other countries can prove efficient in reducing the cost and time needed for training-intensive adaptations and innovations, and acquisitions with a long life-cycle. The identification of capability gaps and possible innovations requires constant monitoring of developments relevant to civil protection in an international context, for which close cooperation with industry and research is beneficial. New instruments and methods used abroad should always be critically examined before being adapted to the Swiss context.

Increased knowledge exchange at home

New risks arising from the trends often fall under the responsibility of several authorities, both federal and cantonal. Existing knowledge about these risks, and ways to mitigate them, is therefore often scattered across several authorities in different departments and/or at different levels of government. In addition to international exchange, interdepartmental and internal dialogue between relevant experts should be promoted and deepened through joint projects and exercises. Some trends, such as digitalization, in turn open up new possibilities to share knowledge and information, making it easier to work together virtually and to avoid duplications.

Autonomy in a complex world

While more coordination and cooperation can significantly enhance the identification and reduction of new and aggravated risks, which result from growing interdependencies, it is not a panacea for eliminating susceptibility to disruption. Technology-dependent societies, like Switzerland, are so vulnerable to failures of certain services, that even a brief disruption can cause great damage. It is therefore appropriate to explore the possibility of, at least, temporary autonomy of key services, infrastructures, and supply chains, to ensure minimal functionality for a short period of time while society adapts. In areas where this is impossible, other ways should be found to minimize damage from failures, for example, by creating stocks or redundancies. The importance of such autonomous fall-backs was demonstrated by the coronavirus pandemic. For example, the sharp rise in demand for various medical consumer goods largely produced in Asia, led to a rapid and critical supply bottleneck in the rest of the world.

Efficiency against cost pressure

Both the complex risks and the new opportunities arising from the trends are increasing the need for specialised resources and personnel in civil protection. This will further intensify the cost and efficiency pressure of civil protection. Accordingly, sound and efficient processes and structures that avoid duplication, and make maximum use of synergies between all federal and cantonal actors, are important for Swiss civil protection. Where this is not yet the case, increased pooling and sharing of personnel and resources would be sensible. This could be extended to activities, such as national and international research and development, in order to integrate emerging opportunities more cost-effectively into civil protection.

15.3 Provision despite uncertainty

The trends identified in this analysis are part and cause of major technological, environmental, and social changes expected in the coming years. In many cases, these trends also interact and influence each other, which entails a high degree of uncertainty with regard to their development and resulting implications. This aspect was already noted in 2014. Since then, uncertainty has generally increased due to the accentuated development and effects of trends, such as digitalization and climate change. The coronavirus pandemic further increases uncertainty about how many of the trends will develop. Previously unknown hazards and their interconnectedness, for which there is little to no historic precedence to guide predictions and mitigation, will pose great challenges for civil protection organizations in the future. Acknowledging uncertainty should therefore have a firm place in the work and development of civil protection. Yet, even in such a dynamic and complex risk landscape, various measures can be taken to optimize safety levels, reduce vulnerabilities, and minimize the effects of disruptive events.

Efficiency through resilience

Today, the concept of resilience is an integral part of civil protection and disaster risk reduction worldwide. Building resilience typically consists of a combination of approaches, such as redundancy, diversification, modularization and decentralization. In public debates, resilience is often reduced to redundancies, which seems to contradict the idea of efficiency, especially in times of ever-increasing cost pressure. In the context of civil protection, however, resilience has to be understood as a bottom-up, societal approach, in which the responsibility of preparation for, management of, and regeneration from disruptive events is not borne by state actors alone. Instead, it is distributed by involving all elements and levels of society. A stronger, more proactive integration of individuals, communities, and the private sector in civil protection, offers many advantages in today's socio-technically complex society. By enabling the various societal actors to respond more effectively to disasters, and recover from them more sustainably, such an approach reduces the potential for damage from both known and unknown risks. It also decreases the need for, and cost of, risk-specific preventive measures. In addition, it helps to relieve the burden on public authorities in the event of disasters. In recent years, Swiss civil protection has begun to pursue the resilience approach more actively, for example, by involving operators of critical infrastructures more closely, and by fostering the cooperation between the different levels of civil protection. These efforts should be continued and, where necessary, extended, for example, through greater utilisation of vol-

untary ad hoc engagement, and by involving additional civil society actors. The coronavirus pandemic has demonstrated how important the engagement of a wide range of actors from civil society and industry can be for the management of emergencies.

Individual preparedness complements state provision

With a dynamic risk landscape, it has become more challenging for civil protection organizations to guarantee the safety of people. As the impact of disasters become more far-reaching, and often as yet unknown or unforeseeable, both the costs and resources required to mitigate and respond to them are increasing. True to the resilience approach, individual preparedness is therefore gaining importance again for civil protection. In addition to the development of an appropriate risk perception, this should include concrete preparations by individuals, such as a personal emergency supply or the acquisition of useful skills. To this end, the task of civil protection is to inform and build a sense of individual and collective responsibility, to enable people to prepare appropriately, and to provide support when needed. However, as a significant part of the population is likely to continue to either lack the necessary resources and skills, or be reluctant to prepare for a possible disaster, civil protection authorities must continue to prepare for the protection of vulnerable members of the population.

Meeting uncertainty with flexibility

In its work, civil protection in Switzerland already has to cope with diverse risk conditions, provisions, and capabilities, depending on where an event occurs. Many trends in this analysis will potentially accentuate these differences. The preconditions and needs of the population in urban areas in the event of a disaster, will differ from those in rural or alpine regions, for example, due to demographic change or varying mobility. Many of these developments are happening rapidly, bringing about complex changes in the environment in which civil protection organizations operate, while being difficult to anticipate. In order to cope with uncertainty and emerging expectations and needs, it could be advantageous for Swiss civil protection to maximize its operational and institutional adaptability. In addition to increased pooling, and sharing of expansive and sophisticated resources between the individual organizational elements, greater flexibility could be achieved by making participation in civil protection more accessible. This could be done by opening up certain militia positions or integrating ad hoc volunteers into existing structures.

15.4 Trust through communication

The future systemic implications of the analysed trends underline the importance of a joint approach by all components of the Swiss civil protection system. This concerns not only possible adaptation strategies with regard to structures or capabilities, but also communication. The assessment in the 2014 report of not overly centralizing communication to ensure citizen engagement, has since become more important due to the increase in mis- and disinformation, particularly via social media. Today, effective risk communication, above all, requires trust – trust in the provider and the content of the message. Various factors can promote the achievement of this goal.

Continuous dialogue with the population

In risk communication, trust must be established before an event occurs, and must be renewed continually. In order to foster reliable civil protection information, efforts should be intensified to achieve a continuous dialogue with the population on relevant issues. Using communication channels, which different population groups are familiar with in their everyday lives, will aid this effort. Two-way communication is more efficient than one-way communication, as its interactivity can help to keep important issues on the public agenda for longer. Citizen-oriented dialogue on issues relevant to civil protection should, on the one hand, be understanding, active and solution-oriented. On the other hand, it should include appropriate crisis communication to which all sections of the population have equal and easy access. With the launch of the multilingual and expandable application AlertSwiss, Swiss civil protection has taken a promising step in this direction since the 2014 report. In order to further promote dialogue with the population, and to keep AlertSwiss relevant in the information space, it could be advantageous to expand the interactivity of this application, and to involve additional societal actors, such as trusted operators of critical infrastructures. However, other forms of communication should not be forgotten, and could be utilised more actively by civil protection, in order to engage as large a part of the population as possible in such a dialogue. This includes traditional means like sirens, radio, TV, and brochures. The official information campaign in Switzerland during the coronavirus pandemic serves as a good example of how critical risk knowledge can be communicated quickly and continuously to large parts of the population, in an understandable format, by using a large number of different communication channels and forms of information.

Coherent and tailored messages

In Switzerland, civil protection is a complex system, with many different players, who must coordinate their communication in terms of content and language in order to be effective. In view of the possibilities of two-way communication, and the flood of mis- and disinformation in social media, the importance for confidence-building through open and coherent communication by civil protection, which also addresses uncertainties in the prognosis of disaster events, has increased since the 2014 report. Civil protection should actively acknowledge that it is only one of many message providers that competes with a flood of other information. It must therefore ensure that it is an attractive source of short, relevant information, particularly during disasters. Messages for one-way communication channels cannot simply be transferred to others, but must be tailored to the medium used and the intended target groups. Messages that are jointly formulated to ensure coherence, but adapted to local conditions, and communicated through familiar local authorities, can help to increase both the attractiveness of the information and the trust in the messenger.

15.5 Towards future-proof civil protection

Civil protection is a comprehensive societal task that must be tackled cooperatively by actors from all relevant sectors of society in a holistic and systemic manner. This fundamental principle was demonstrated by the coronavirus pandemic. In our hyper-connected world, the technological, social, and environmental trends analysed in this report, will put Swiss civil protection to the test in years to come, by creating new challenges and exacerbating existing risks. However, they also offer new opportunities and hitherto unknown possibilities in the field of civil protection.

To be future-proof, the relevant actors in Swiss civil protection should take an in-depth look at the trends identified in this report, to ensure the necessary adaptability is developed to address the likely, and yet unknown, impacts. They should proactively and decisively take advantage of the opportunities that arise with these trends. This way, they can make valuable contributions that will maintain and increase the resilience of Swiss society against the challenges that lie ahead.

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Appendix – Overview of Key Findings

Challenges

Opportunities

Policy Implications

Artificial Intelligence

<ul style="list-style-type: none"> • Deep learning models are still largely a black box • Feeding machine learning models with adversarial inputs can lead to erroneous predictions • There is little or no historical training data for rare, catastrophic events • AI could aggravate some cybersecurity concerns • States could use AI for mass surveillance and censorship, enabling high-tech authoritarianism 	<ul style="list-style-type: none"> • Early detection and real-time surveillance of pandemics may become more viable • AI can offer multilingualism to rescue teams and support disaster hotlines • ML can be used for predictive maintenance, predictive policing, etc. • Combining ML with weather data, flood or landslide forecasting could be used for timely location-based warnings • ML can monitor, prioritize and map all kinds of multimodal data into human-readable formats 	<p>On an organizational level, Switzerland needs to pool data and human resources to enable the use of AI by public authorities. Machine learning and automated decision-making algorithms should only be used in civil protection if results are explainable, and in line with civil liberties. Switzerland could adapt ideas provided by the white paper on AI by the European Commission on regulating the use of AI in high-risk applications.</p>
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Changing Demographics and Social Norms

<ul style="list-style-type: none"> • Elderly people and migrants have the potential to be more vulnerable during crises • Cultural and religious diversity could make it increasingly difficult to create a common understanding of state and individual responsibilities • More heterogeneous population can cause personnel shortages in crises, as the pool of eligible and motivated candidates for the militia system shrinks 	<ul style="list-style-type: none"> • Demographic change could create a more diverse and potentially larger recruitment pool for civil protection systems • Broader inclusion of the elderly, immigrants, and women could increase resilience • Better integration of different groups could help to understand group-specific vulnerabilities • Recruitment problems offer opportunity to reflect on future of the organizational form of civil protection system, e.g. professionalization vs. system based on volunteerism 	<p>Civil protection authorities need to intensify communication with the Swiss public about the importance of the Swiss civil protection system, adjust certain processes, and make the militia system more attractive and accessible for so far underrepresented population groups like migrants, women, and elderly people. This might include creating more opportunities for ad hoc, short-term, voluntary engagement, and adjusting the requirement profiles for military and civilian service.</p>
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Climate Change

<ul style="list-style-type: none"> • Increased risk of flooding due to extreme precipitation events, especially in winter • More heat waves and periods without precipitation in lower altitudes and south of the Alps • Increased risk of spread of tropical diseases due to higher temperatures • Increased risk of large-scale forest fires, south but also north of the Alps • Reduced stability of infrastructures built on thawing permafrost 	<ul style="list-style-type: none"> • More reliable information on climate change enable better adaptation strategies • Civil protection system is experienced concerning hazards that are likely to grow due to climate change, such as flooding, forest fires, etc. • Warmer temperatures reduce the number of illnesses caused by cold, etc. • Shorter duration and extent of snow cover in the Alps improves the conditions for the use of solar energy 	<p>The results of the FOCP project “Civil Protection and Climate Change” need to be used to revise existing protection concepts and adapt structures. New possibilities, such as impact-related warning and deployment of emergency forces, should be taken into account. Federal authorities in Switzerland need to strengthen cross-agency cooperation. The same accounts for international cooperation to use existing knowledge concerning climate-related hazards.</p>
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Challenges

Opportunities

Policy Implications

Convergent Technologies

- Lack of understanding the convergence of technologies
- Convergence in bio-chem sector creates new risks and problems
- New technologies allow plants to be modified without being recognized as Genetically Modified Organisms
- Democratized access to bio-tech developments creates cyber-biosecurity threats
- Converging technologies in bio and cyber sector results in security challenges for privacy and data security
- Regulation is difficult due to current silo approach

- In the context of pandemics, novel treatments and detection methods become possible
- Digital epidemiology could be a powerful new means of detecting and tracing epidemics and pandemics
- Synthetic biology is permitting new and faster means of developing (personalized) vaccinations and medication
- Infrastructure monitoring using chemical or biological sensors (microorganisms)

Given that convergent technologies by definition cross disciplines, developing capacity to understand how regulatory questions and problems can be addressed at the governance level should be a priority with respect to this trend. In this context, the Spiez Convergence conference, hosted by the Labor Spiez, entails a promising format that brings a broad range of experts and policy makers together to discuss and share information on convergence in the biology and chemistry fields.

Digitalization

- Digitalization causes proliferation of connected devices offering new targets for cyberattacks
- As IT mainly is built outside of Western countries, there can be a problem of trust with suppliers regarding espionage, backdoors, etc.
- Digitalization may hinder resilience, because people rely on digital technologies and become analogue analphabets
- Many questions concerning privacy rights, lack of data protection, and potential for surveilling and controlling population are still open

- Digital technologies facilitate and/or enable new disaster management measures, e.g., UAV, digital triaging (see respective trends)
- Building information modelling (BIM) could be a useful tool for first responders and relief forces, providing them with previously unavailable, easy to understand information
- 5G networks could provide stable communication during emergencies, if they allow for the exclusion of non-critical devices

The civil protection system in Switzerland has to address topics like 5G, BIM, cybersecurity, and an overreliance on IT systems in virtually all of its current and future work. Examples could include research on adapting existing BIM tools towards the needs of relief forces. Or performing large-scale exercises about indirect effects of cyberattacks across different infrastructure sectors and the public. Not least, it is necessary to adapt regulation towards new technological developments and the specific needs of civil protection.

Geopolitical Change

- Development towards more national approaches with pattern of independent, less coordinated foreign policies
- Lack of resources due to the decrease of state-level support is threatening international organizations' ability to act
- More asymmetric and hybrid threats such as terrorism and cyber-attacks
- Concentration of production capacities and lack of buffers in global supply chain could lead to shortages in case of large-scale disruption

- Increased demand for mediation and good offices due to tense international context and rising levels of fragmentation
- Emergence of more polarized geopolitical structures creates room to maneuver towards more independent foreign policy
- Increase in national defense spending becomes more likely, and might also include increased budgets for civil protection

With respect to a volatile geopolitical situation, policy instruments and national strategies must be able to anticipate and cope with the highly dynamic international context. Switzerland should see civil protection as embedded within a larger framework of national security. International cooperation, e.g., with NATO or EU civil protection and disaster management bodies, should be intensified. At the same time, a degree of independence and autonomy should be maintained.

Challenges

Opportunities

Policy Implications

Governance of Critical Infrastructure

- Tightly coupled systems could be prone to cascading effects, where small failure can rapidly cascade through the system
- Lack of knowledge about, and capacity to manage, actual interdependencies between infrastructures and sectors
- Sectorial governing logic for critical infrastructures could lead to lack of cooperation if faced by systemic threats
- Common cyber vulnerabilities due to similar IT systems used in different infrastructures

- Complexity and tight coupling permit implementation of principles like decentralization, diversity, and modularization
- Advanced digital technologies could be used to discriminate between different users of CI, prioritizing critical systems
- Similar control systems enable people to change between sectors, deepening cross-sectoral knowledge and understanding
- Tightly coupled systems could enable positive cascading effects, such as vaccinations

The Swiss civil protection system should address increased complexity and interdependency of critical infrastructures in three ways: fostering European coordination, exploring the possibility of insulating critical Swiss systems, and deepening the knowledge about actual interdependencies between sectors.

Mobility

- Richness of sensors that AV use to navigate, including cameras, creates high mobile network requirements and raise privacy concerns
- Possibility of a fleet-wide hack increases the damage potential of a cyber-attack
- More autonomous taxis and ride-sharing might reduce capacity to quickly evacuate large swaths of the population
- A need to charge many EV at the same time might result in a shortage of electricity during evacuations
- Autonomous cars may be less apt than humans at driving in severe weather conditions

- AV increase general road safety
- Large collective energy storage capacity of EV can help to make the electricity grid more robust
- AV are mobile sensor platforms and could therefore monitor health signals of passengers
- AV offer point-to-point mobility for evacuations, especially for people who cannot drive
- AV that are not needed to transport people to safety can position themselves outside of hazard-affected areas
- AV increase difficulty of vehicle attacks, as terrorists cannot simply steer it into a crowd

The Swiss civil protection system should start to implement the large-scale availability of AV and EV into its emergency planning to avoid surprises during disruptive events. Switzerland should not overlook differences between its urban and its rural areas (especially alpine).

Sharing Economy

- Effective pooling demands high level of standardization
- It is difficult to develop complex technical systems with many synchronized elements
- Transporting geographically highly distributed resources can cause considerable logistical problems in crises
- Sharing resources means a decrease of redundancies
- Sharing critical assets preconditions a high level of mutual confidence

- Sharing and pooling allows a higher level of specialization of individual actors
- Reliable sharing mechanisms allow for concentrating on most probable hazards in every region without sacrificing preparedness for other hazards and black swan events
- Joint activities and coordination efforts can be effective ways to increase confidence and trust among actors

Sharing resources appears particularly logical in countries with small jurisdictions, like Switzerland. Sharing is most attractive for highly specialized and cost-intensive machines and services that are needed only occasionally. However, crises affecting many countries simultaneously also set certain limits to the usefulness of such approaches.

Challenges

Opportunities

Policy Implications

Social Media

- Organized adversaries can use social media for disinformation campaigns to undermine trust in government institutions
- Adversarial campaigns could significantly expand in the future and specifically target critical infrastructure sectors
- Once information is online, it can easily be taken out of context, manipulated, or falsified
- Stakeholders often lack critical insights into how populations use social media to communicate

- Civil protection authorities can increase the reach of their communication, and address target groups more precisely, e.g., in a disaster zone
- Social media allows population to give direct feedback, thereby helping civil protection to adapt their preparations and operations
- Social media enables informing a large number of people quickly, simultaneously, on the move, which can help to relieve the burden on emergency call systems

For civil protection authorities, the major challenge is to work out when to communicate, with what audience, through which channels, using what messages, and at what pace. Despite their advantages, social media should not replace other forms of communication in the civil protection system (radio, sirens, meeting places, etc.).

Unmanned Systems

- UAV and UGV applications are still not at the TRL to perform well under degraded communication and extreme weather conditions
- Explosives or rifles mounted on UAV could allow for cheap, remote, unaccountable, and targeted killings in the future
- UAV can interfere in the airspace around airports and force costly shutdowns
- Critical infrastructures with a large threat area are hard to defend against a coordinated attack of UAV
- Adversarial actors are already using UAV to spy on police, prisons, or critical infrastructures

- UAV can be used in hazardous environments, confined or otherwise inaccessible areas
- UAV can be used to create vulnerability and risk maps of, e.g., unplanned settlements, where mapping the exact locations of buildings, land use, roads and drainage, or natural features are underdeveloped
- UAV or snake-like ground robots could roll and/or fly into complex structures and safely search for signs of life
- Swarms of small UAV will probably be able to scan relevant areas and buildings, with high automation, and in a coordinated manner

Switzerland should continue to support both the development of a suitable regulatory framework (U-Space regime) for use of unmanned systems in civil protection, and the technological development to solve issues, such as a lack of robustness, endurance, and indoor-navigation capacity.

Urbanization and Metropolization

- Growing populations puts pressure on infrastructures
- Unmanaged urbanization may place communities in hazard-prone areas
- Densely populated areas enable rapid growth of infections in a pandemic
- Evacuation of urban populations could overwhelm surrounding communities
- Processes like gentrification could threaten social cohesion
- Sustainable urbanization requires coherence between human, technological, and institutional factors

- Availability of data enables better infrastructure planning for complex urban areas
- Urbanization could create an opportunity for more collaboration across administrations and sectors, as well as to enhance resilience by engaging in land planning issues, which aim to mitigate risks
- Risk management for urbanized areas should consider different dimensions of coping capacities better, e.g., urban population being less self-sufficient than rural but having easier access to more resources

Swiss civil protection authorities should link hazard mapping exercises between federal and cantonal levels to enhance coordination and improve transparency. Emergency managers should also periodically reassess population movements, and adapt evacuation procedures and routes accordingly. Risk and safety analyses, and risk communication processes, should be incorporated directly into the broader land-use planning processes and across administrative boundaries.



The **Center for Security Studies (CSS) at ETH Zürich** is a center of competence for Swiss and international security policy. It offers security policy expertise in research, teaching and consulting. The CSS promotes understanding of security policy challenges as a contribution to a more peaceful world. Its work is independent, practice-relevant, and based on a sound academic footing.