Research for a Safer Society

MSB Research Programme 2011-2013

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Foreword

The task of the Swedish Civil Contingencies Agency is to work proactively in order to ensure a safer and more secure society. To this end, the development of knowledge is an important prerequisite. By initiating this research programme, the MSB wishes to inspire new research proposals and direct research efforts towards important areas of knowledge in the field of public safety, civil protection and emergency preparedness.

The research programme is oriented, first and foremost, towards researchers interested in the questions and issues arising from the fields of public safety, civil protection and emergency preparedness. The MSB hopes, however, that the programme will be observed with interest by other authorities, funders of research and entities within both the MSB's area of competence and in those of neighbouring sectors.

The programme consists of two main sections, the first of which describes the points of departure for the authority's orientation and funding of research, the background, conditions and a number of general perspectives and principles for MSB research.

The second part of the programme outlines the field in which the MSB wishes to initiate knowledge building during the period from 2011 to 2013, and it is described in general terms. A more specific orientation of research takes place based on more detailed information and mapping of knowledge requirements. In addition, orientation also occurs as a result of calls for proposals focusing on restricted areas or issues.

The research programme constitutes a platform for cooperation between various stakeholders, authorities, the private sector and research organisations. This form of collaboration between academia and society is highly sought after to solve practical issues efficiently, and to spread the knowledge and results obtained throughout society.

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The MSB's Orientation & Funding of Research

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The first section of the research programme describes how the MSB works on research issues. A concise account of the MSB's assignment and goals are provided to place these in context, after which the principles that steer the orientation of MSB research are presented, for example, criteria for financial backing, cooperation and communication. Finally, the different forms of research funding are described.

Swedish Civil Contingencies Agency

"A safer society in a changing world."

This is the vision of the Swedish Civil Contingencies Agency, whose objectives are to develop and reinforce public safety and ensure sound emergency preparedness, where everyone has a responsibility. The MSB's overall goals are to reduce the risk of emergencies and crises and develop and support societal emergency preparedness for if and when they occur, and mitigate their consequences. In collaboration with other societal entities, the MSB shall safeguard the lives and health of the population, societal systems and infrastructure as well as the capacity to uphold fundamental values and democracy, law and order and human rights.

The MSB's responsibility covers measures taken before, during and after an emergency or crisis, encompassing the entire threat and risk scale, from minor, everyday emergencies to major disasters, crises and periods of heightened preparedness. The MSB shall be a driving force in establishing and developing preventive measures which reduce vulnerability.

Knowledge is required in order to strengthen public safety, civil protection and emergency preparedness, knowledge of how society is currently structured and functions and how we can make it safer and more secure for the future. Research is one of the most essential means of developing knowledge and the MSB has been assigned to direct, order and ensure the quality of research in order to ensure that relevant research is carried out within the authority's fields of responsibility. In addition, the authority shall communicate research results to those target groups most in need

of them. Research funded by the MSB should support the authority's task and contribute to the fulfilment of its vision and goals.

The MSB has highlighted six areas on which to focus its operations from 2010 to 2013. Other activities will be run and developed during this period, but the focus areas will constitute part of a collective joint focal point and form the basis for the research priorities that the MSB decides to fund during the period.

- Meeting the consequences of a changed climate
- Making good use of society's collective resources
- Developing the prerequisites for management and coordination
- Developing municipal work on public safety, civil protection and emergency preparedness
- Developing the MSB's exercise of authority with respect to the individual
- Clarifying goals, responsibilities and dependences

Starting Points for Research Orientation

Support for and orientation of research constitutes long term means of development. The MSB acts in accordance with a number of criteria and principles in order to achieve the consistent and continuous orientation of research.

Research as a Strategic Resource

Research has a central and strategic significance for the MSB and for development in the field of public safety, civil protection and emergency preparedness.

Its purpose is the long term building of scientific knowledge within the area of responsibility. This helps to formulate relevant questions today and to identify the knowledge requirements of tomorrow. In addition, the research contributes towards skills and expertise provision within the MSB's areas of responsibility in the form of experts and an awareness of the authority's key issues.

The research undertaken in the MSB's areas of responsibility is vital for the authority's role as a driving force in societal safety

efforts. On this foundation of research, conditions are created that enable the provision of advice and support to those entities operating in the MSB's areas of responsibility as well as training of the highest quality.

Principles for Funding Research

The point of departure for the orientation of MSB research is society's knowledge requirements in the area of public safety, civil protection and emergency preparedness. Continuous work is carried out in order to take an inventory of existing knowledge and deficiencies in different research areas, map and describe knowledge requirements.

Research projects funded by the MSB shall deal with issues relevant to the authority's fields of responsibility and interest. Furthermore, research should be of a high scientific quality, ensured, for example, by the MSB's science committee, which consists of proven competent researchers within the authority's specialist areas. This body is in charge of assisting the MSB with assessing applications and providing advice of a scientific nature.

The above-mentioned attributes – societal **needs**, **relevance** to the MSB's areas of responsibility and sound **scientific quality** – are the fundamental prerequisites for all research funded by the MSB. There are, in addition, a number of principles which determine the orientation and priority given to MSB research funding.

Multi and Cross-Disciplinary Research
The MSB has a broad research field which incorporates research in several scientific disciplines. Frequently in modern society, the truly interesting research issues and the greatest challenges are to be found in a combination of research areas. Cross and multi-level scientific research efforts might even be said to be a prerequisite for describing, analysing and understanding, for example, the meeting between human beings and technology, or the interplay between economics and the environment. Consequently, the MSB strives to bring about cross- and multi-disciplinary research projects involving research participants from different disciplines.

Applied Research
Research supported by the MSB is initiated because of a need in society and consequently, those research projects carried out

are, first and foremost, of an applied nature, oriented towards acquiring new insight, new methods or new products that lead to enhanced public safety.

The User's Perspective

As a rule, the user's perspective will be integrated into research funded by the MSB. Research may benefit by including studies in which researchers and users collaborate in shared knowledge development within a mutual learning process.

International Perspective

Research funded by the MSB must be internationally competitive and be part of the international knowledge development. Consequently, the MSB encourages research that incorporates cross-border collaboration and projects that place research issues in an international context.

Diversity

The MSB shall be an open, competent and dynamic authority dedicated to the individual and society. To this end, diversity is an essential prerequisite. At the MSB, all work on preventing discrimination is referred to as diversity management. The MSB encourages research applications that take diversity into consideration, and upon assessment even the research group's composition is considered in terms of diversity.

The Environment

Research projects that integrate an environmental perspective are encouraged. The MSB's environmental policy stipulates that the authority shall operate in a way that considers the environment and sustainability and has an integrated approach to safety – health – environment within the fields of public safety, civil protection, emergency preparedness and civil defence. Research funded by the MSB shall be conducted with consideration for the MSB's environmental policy.

Collaboration

The MSB's field of operations spans a number of societal sectors. Accordingly, a proper grasp of its issues demands fully developed collaboration with other authorities, the private sector, organisations and higher education institutions. The MSB's work is conducted, to

a large extent, through different networks. The MSB strives to enhance the impact of its own research resources by arranging joint calls for proposals with other authorities.

The MSB's orientation and funding of research must be viewed in an international context. The Nordic countries face similar safety and security challenges. The MSB works with its Nordic counterparts in order to find answers to common questions and expand Nordic research collaboration within the field of public safety, civil protection and emergency preparedness. As a result, the Nordic region reinforces its profile as a research actor within the EU and on an international level.

The MSB endeavours to achieve successful Swedish participation in the EU's Framework Programme for Research and Technological Development as well as in other similar research programmes in the USA, for example. One aspect of this endeavour is to be present and active in the EU initiatives taken and to participate in various EU groups concerning the authority's fields of interest. The MSB is also responsible for coordinating national efforts in the framework for the existing agreement between Sweden and the US Department of Homeland Security (DHS). The general goal of the agreement is to initiate and promote lasting collaboration between the MSB and the DHS, between Swedish authorities and their counterparts within the DHS sphere as well as between public and private Swedish research organisations and their American equivalents. Planned and ongoing research orientation in the Nordic region, the EU and within the framework for the DHS collaboration, are considered with respect to the orientation of MSB research funding.

Utilising Research Results

The new knowledge that research generates is disseminated, applied, and developed into new skills, methods and products in order to reach and have an impact on society. Communication and the dissemination of research results are natural parts of the MSB's research commitment. Target groups include the scientific community, authorities, municipalities, county councils and county administrative boards, as well as the general public and students at universities and colleges. The MSB works constantly with researchers to develop communication of results from research projects, including popular science summaries of

research results and through circulation via seminars for different target groups. Cooperation between users, research providers and industry is vital so that research results may be utilised and implemented effectively in technologies, systems, products and measures that are well adapted for societal use.

Forms and Guiding Principles

The MSB follows an established procedure incorporating a number of different forms of support in order to ensure the quality of its research funding efforts. This procedure and the various forms of funding are outlined here:

Application and Deliberation Procedures

Most of the MSB's research funds are allocated via calls for proposals. A call can either be open, which means that it is based on the general orientation set out in the MSB's current research programmes, or themed, which means that the call is within a clearly defined theme in the applicable research programme. Researchers and research teams at colleges, universities and research institutes may apply for MSB research funding.

The MSB welcomes participation from the private sector and other stakeholders in research applications and projects, but the guiding principle is that the main applicant must be based at a university, college or research institute. The main applicant for a project must hold a PhD and be an active researcher in Sweden. Information on what an application must include is published on the MSB's website in connection with each call. Applications that are submitted to the MSB are dealt with in line with a fixed and established deliberation procedure. An MSB deliberation committee is in charge of assessing the relevance of applications.

The needs assessment of applications is carried out by a panel of expert advisors within the field concerned; these specialists may even be enlisted externally. Scientific analysis and evaluation is carried out by the MSB's scientific committee in consultation with researchers co-opted from universities, colleges and research institutes throughout the Nordic region.

Forms of Funding

The MSB works with different forms of funding. The main principle is to announce calls for proposals relating to research funds, which are then applied for competitively. Information about calls in progress may be found on the website www.msb.se.

Research Projects

A research project is most often restricted to answering a specific issue and, typically, it is carried out within a period of three years. Funding is initiated ordinarily by announcing a call for proposals that may either be open or thematically oriented.

Framework Programmes for Research

Framework programmes for research are broader in scope than an ordinary research project. In addition, they are preferably cross-disciplinary and research is conducted within a specific theme or area. The framework programme is often comprised of several sub-projects and, as a rule, runs for a period of 3-5 years. Financial backing of framework programmes for research is usually initiated through a call directed towards a clearly stated and demarcated area or theme.

Competence and Structural Support

Competence and structural support is the most general in scope of the MSB's forms of funding, in the sense that it comprises several different forms of support. Its purpose is to support the establishment and development of competencies, research environments, networks, research centres and the like. It also includes support for individual researchers with orientations that correspond to the MSB's fields of responsibility. The latter takes place in the form of post-doctoral support for quite recently qualified researchers. In addition, the MSB may provide support for establishing professorships for studies that fall within the authority's field of knowledge and competence.

Planning Support

By providing planning support, the MSB aims to encourage re-searchers to participate in European and international research projects. This may involve financial aid for their work in formu-lating applications for research funds and building networks in connection with research applications.

Research for
Civil Protection
and Emergency
Preparedness

Research for Civil Protection and Emergency Preparedness

The following part of the MSB's research programme is a description of the research areas and research requirements in the MSB's field of responsibility as a government authority. The description is general and should provide an overview of the research area with examples of potential research projects. The text is intended as guidance and a source of inspiration for research ideas. Referring to this research programme, the MSB draws up a detailed needs analysis as the basis of priorities and individual calls for proposals. The text is arranged in three programme areas, which partly overlap one another and are not intended to limit research work. One research issue may well have a bearing on several areas. The first programme area, *A Safer Society,* gives a general overview of the context in which society's safety efforts operate. The second, *Risks, Threats and Vulnerabilities*, describes specific risks, threats and vulnerabilities in society and issues pertaining to how we might become better at preventing and managing them. The third, *Prevent, Prepare, Manage and Learn,* concerns new knowledge about the operations of entities within public safety, civil protection and emergency preparedness and how their methods, equipment and tools may be developed and updated.

Research issues within public safety and preparedness, may be regarded from different perspectives. The MSB has an equal interest in research from the perspective of the individual, groups and society as a whole. New knowledge is needed about a local and regional level as well as the national and international levels. The time perspective may also vary and relate to before, during or after an emergency or crisis. In addition, it is essential to apply the perspective of diversity throughout the entire field of MSB operations. Our differences, for example, in ethnicity, religion, social class, gender, age and functional impairment, greatly influence how we approach our own lives and living in society with all the risks, emergencies and crises that this entails. Issues involving diversity are relevant tor several of the research programme areas. It is possible to apply the various perspectives to fields far beyond those expressly stated within the text of the programme. Other views may of course be adopted.

Programme Area 1
– A Safer Society

Programme Area 1 – A Safer Society

In line with societal development, the web of entities, areas of responsibility, dependences, vulnerabilities and potential threats and risks is growing increasingly dense and complex. The more complex society becomes, the more difficult it is to prepare for and manage risks and threats. In fact, success in such efforts requires having a holistic view, coordination, collaboration and cooperation across societal levels and between authorities, on a national as well as on an international plane. This first programme area aims to present overall aspects of the vulnerabilities present in societal structures and how a safer society may be created. In addition, the role of the individual is discussed. The description begins with a number of trends whose consequences for the field of public safety, civil protection and emergency preparedness need to be explored.

Societal Trends

The world and society is undergoing constant development. In order to ready ourselves for the emergencies and crises of tomorrow, it is vital to consider what impact changes in the environment may have on the societal safety and preparedness. We need to know more about how risks, threats and vulnerabilities evolve in line with societal developments and what new risks, threats and vulnerabilities may emerge. It is also a challenge to create the capacity to prevent and manage them. At present, it is possible to discern a number of trends and potential developments for the future.

Research is needed to predict the impact that these social trends might have on the areas of public safety, civil protection and emergency preparedness and how we should manage these changes. Below, in brief, are some of the trends which, according to the MSB, should be analysed for further information and knowledge. Alongside these trends, there must be preparedness for new and perhaps contradictory developments leads that may place other demands on societal capacities.

Over the coming decades, while the age distribution in Sweden and large parts of the western world will be shifting towards an increasingly elderly population, the economical and social divide will widen. This will have an impact on people's capacity to deal with emergencies and crises.

There is an increasing individualisation of society and lifestyles are changing, which has implications for how people behave in relation to risks, emergencies and crises. The rise in travel is generating new risks. A higher consumption of alcohol, drugs and medicines, is affecting the instance of personal risks and threats as well as the action taken to handle them and need for societal support. Ongoing globalisation is resulting in increasing mobility and faster global flows. In the long run, globalisation may lead to a shift in the international balance of power and the redistribution of prosperity among between states. Global economic growth will most likely continue, but because that growth is not equally strong in all countries, assets will be distributed unevenly. This may in turn lead to increased migration. The number of armed conflicts has steadily declined, but the political security situation is constantly changing. Global and regional conflicts may even cause instability in Sweden. Competition for natural resources may create conflict and vulnerability and impact on civil protection and public safety.

In addition, the climate is changing. Climate change signifies, for example, higher average temperatures, changes in precipitation and wind conditions. Changes in the extremes and natural variability can result in dramatic consequences throughout the world. Society needs to be able to adapt to these new conditions. Technology is developing in many areas very rapidly and has had a major impact on civil protection and preparedness. In many cases, new security solutions have been created, but at the same time, new vulnerabilities in technical systems have emerged. The risks of new technologies, especially in the long term, may be difficult to predict.

The media has undergone major restructuring as a result of rapid IT development. Information transfer has become much faster and new types of media have emerged. The individual has been given a greater role as a broker of information, which provides both new opportunities and new challenges in communicating risk and crisis information.

Building a Safer Society

How should we go about building a more secure and safer society? This fundamental issue encompasses the entire spectrum from planning and prevention, to implementing measures, managing threats, emergencies and crises, and finally follow-up and learning. Research is needed into issues of how best to organise and maintain a working system for societal crisis management, improve societal resilience to crises and its ability to recover from a disaster or crisis. Research is also needed into providing the capacity to meet unknown threats and risks which may be just around the corner even if we are currently unaware of them.

Preventing and dealing effectively with those emergencies and crises liable to affect society requires a holistic approach in the areas of public safety, civil protection and emergency preparedness, for the entire scale of events ranging from small to large and the wide range of entities involved. Effective management relies on coordination and cooperation between entities.

Safety work is conducted each day at various societal levels and requires legislation and regulations, as well as acceptable levels of risk and methods to balance various interests against each other. Decision-making, policy work and negotiations at national and international levels must be supported by information based on scientific findings and be of a slightly different nature than what is relevant to work on the local level. Decision-makers and operative entities need to share relevant information in order to create a reasonable shared comprehension of both the overall situation and individual large events. The programme area "Prevent, Prepare, Manage and Learn" will deal with leadership, coordination, collaboration and information management in a more operational context. In terms of society's ability to withstand shocks and recover quickly after an event, studies must be made of the factors that may lead to the creation of such capacity in the individual, local society and the nation. More knowledge is needed about vulnerabilities and dependencies in society and how to avoid them. More knowledge is also needed about society's institutional capacity to manage risks and crises, and about the state of regional and global cooperation for similar efforts. In this context there is much to learn from comparative studies and exchange of experience between countries with different traditions and different approaches to issues relating to safety.

Each year society invests considerable resources in emergency and crisis prevention . Further knowledge is required about the consequences of safety measures so that efforts to improve safety may be conducted more efficiently and cost effectively. The MSB wishes to learn more about how methods may be used to prioritise preventive and preparatory measures and, in addition, about the relationship and interplay between the aim of legislation and the initiatives of entities, measures taken and actual effects on society. The cost of prevention work also needs to be studied in relation to potential harm and the cost of managing the emergencies and resulting crises that have occurred. Democracy issues must be considered and explored in order to build a safer society. How important are safety and security for maintaining democracy and to what level of safety should a democratic society aspire? There may also be negative aspects of safety efforts for society. Supervision and regulations may restrict freedom, controlling our lives up to a point that is excessive. At what point does security itself become a threat to democratic values? As society becomes safer, its citizens have greater expectations of living a safe and secure life, while, at the same time, awareness of personal responsibility seems to be low. How does this impact on society and its ability to handle emergencies?

The Role of the Individual in Societal Safety Efforts

All research and development with respect to safety is ultimately about creating a safe and secure society for the individual. An analysis of individual needs is the starting point for achieving this and at the same time allows for the quality of life for all, regardless of condition. A deeper level of insight is needed into people's perceptions, behaviour, knowledge and capacity in terms of safety, risk and crisis issues. People have and express various degrees of awareness about risk values, safety and security, which for each and every individual come from their perception of risk. This is the basis for how people react and behave when faced with risks. Patterns of perception vary over time and among individuals and groups. The MSB sees the need for more research into risk perception and attitudes to safety, especially in everyday life. In addition, more knowledge is required about the relationship between risk perception and behaviour and about the factors that affect this connection.

There is also a need for a more profound understanding of how cultural, demographic and social factors influence individual perception of risks. This requires a clearer link between theoretical research into gender, ethnicity and critical theory and the empirical risk and crisis research. In addition, further knowledge is needed about children's perceptions of risk.

People's willingness and capacity to act in connection with emergencies and crises are influenced by their personal skills and abilities. Some behaviour may relate to routines and individual attitudes. The way in which a person perceives the division of responsibility between the individual and societal entities may well influence how he or she reacts. Therefore, it is pertinent to ask questions about what people can, want and should contribute to public safety. More knowledge is needed about the factors, in individuals as well as structurally in society, which affect human behaviour in emergency situations, victims as well as helpers. It is necessary, for example, to gain a greater understanding of how accountability affects the individual capacity to perceive, make decisions and deal with different situations. Another factor that may affect individual behaviour is the aspect of personal freedom and what the person in question perceives as an affront to their integrity.

Development of new technology and equipment is an area where it is important to take into account the individual's needs and abilities. Technological development can provide new opportunities for preventing and managing emergencies and crises, but the technology must be assessed in its context, which assumes that it is adapted to its users and to the situation in which it is used.

Programme Area 2
– Risks, Threats and Vulnerabilities

Programme Area 2 – Risks, Threats and Vulnerabilities

In order to achieve a safer society, we have to know about the risks, threats and vulnerabilities that exist in society, and also about those that may occur in the future. This second programme area presents some of the areas where there are known risks, threats and vulnerabilities. The underlying causes may be both natural and entity-bound and consequences may impact on people, property and the environment in equal measure. A great many issues in this programme area are of a technical nature and the cross-disciplinary perspective is most certainly relevant here.

Emergencies and Antagonistic Threats

The MSB's area of responsibility encompasses unintentional events and natural phenomena as well as incidents resulting from of deliberate acts. The consequences of these different types of adverse events are often of a similar nature and can be managed using similar means. However, there are major differences if you look at causes and occurrence.

The overall societal cost for emergencies and injuries is extremely high, from a purely economic point of view, but also in terms of personal suffering and damage to property and the environment. Further knowledge is needed about societal experiences of emergencies and the causes and consequences of them. In order to learn and benefit from the experience of past events, it is essential to constantly monitor emergency trends in society and to identify and analyse the threats, risks and vulnerabilities that have led to past emergencies and crises. More knowledge must be obtained about how experience in handling everyday emergencies may be utilised in managing large-scale emergencies and vice versa. Major Intentional emergency incidents are clearly not as common as everyday emergencies, but they have the potential to cause great harm to society. This might entail anything from the minor actions of a single person to organised crime and terrorism. In the case of the latter, the threat situation has changed in recent years. Further knowledge is needed in order to understand the antagonistic threats and their causes. How is the threat status affected by factors such as conflicts, political instability, poverty and social exclusion and how do we deal with threats?

Everyday Emergencies and Fires

The total health burden and mortality in "everyday emergencies" is much more substantial when compared with large-scale emergencies and serious incidents. It is therefore relevant to establish research into issues related to everyday emergencies as they are greater in number than the number of intentional incidents and because combating crime does not fall within the MSB's sphere of responsibility, it is natural in the first place to talk about everyday emergencies. However, many of these incidents may also be the consequence of a deliberate act.

Personal injuries usually occur as a result of incidents involving falls, transport and toxic substances. Research aimed at reducing the number of injuries could, for example, investigate the effectiveness of current prevention work and how it could be improved. Frequently, preventive efforts are targeted at specific groups such as, for example, the elderly, children or disabled. The characteristics that constitute a vulnerable group or group at risk vary according to context. More knowledge is needed about how such groups may be identified and how their position might be considered within emergency prevention projects. Further knowledge must also be gained about the manifestation of vulnerability in everyday life and the implications of pointing out vulnerable groups.

Damage to property is often the result of fire. Although domestic fires are a common occurrence, knowledge is lacking significantly in this area, for example, details of fatality rates linked to fires, persons or groups who risk becoming the victims of fires and the reasons behind these factors. A greater knowledge of structural issues such as the robustness of structures must be acquired, in order to reduce fire hazards in the home and in public places. Issues related to building regulations and codes and fire safety should be studied. How are structural and fire protection requirements interpreted and observed, in order to achieve sufficient standards of fire protection and how will the actual construction process affect the final standard of safety? Additional expertise is also required as to how fire spreads, especially in more complex environments where multiple fire cells and floors are concerned. What impact do factors such as interior fittings, choice of materials and multifunctional buildings have on fire development? In the efforts to prevent and reduce harm caused by fires, knowledge is required about human behaviour during emergency situations,

for example, in order to ensure safe evacuation routes. In this case, it would also be important to consider people with different types of disabilities.

There is still much to learn about the effects of emergencies on the environment. Comparisons are needed between the burden on the environment because of emergencies and the continuous burden from other sources. More knowledge is also needed about the magnitude of emissions from various types of emergencies and the environmental burden involved in managing them. More research is needed into how to measure and monitor emissions into the air, land and water in connection with emergencies . There is also a need for improved methods of assessing environmental risks and suitable measures in connection with a rescue effort.

Hazardous Substances

In society, there is a considerable variety of substances and microorganisms, many of which if used incorrectly can cause great damage to health, property and the environment. Incidents involving hazardous substances can have considerable consequences for society. We need to better understand the risks posed by dangerous substances, how they might develop in the future and how we should protect ourselves from these substances.

A common aspect of many hazardous substances is that more knowledge needs to be acquired about how they affect humans and the environment, especially in the long term. Scientific facts about hazardous substances and proven limit values for acute emissions are important, for example, for assessment of exposure and for clean-up. It is essential that more knowledge is acquired about how different substances are spread in and absorbed by the environment. The development and emergence of new chemicals and microorganisms also present new risks. What new risks will arise from the development of new renewable and environmentally friendly fuels? What will happen when infectious microorganisms change and become more infectious or resistant to antibiotics or when diseases spread due to increased mobility and a changing climate? Society must have the capacity to prevent these new risks through further research.

The safe management of hazardous substances requires research into good safety and security practices for hazardous operations and for certain substances, (explosives, for example) and more

knowledge about the substances themselves, how they react and how to handle them. Development is needed in certain cases within the areas of detection, sampling, identification and quantification of hazardous substances. In addition, more research is needed into methods for distance detection of explosive, chemical and biological substances. Further knowledge must also be gained in order to easily detect and identify hazardous substances in, for example, drinking water and quickly identify and diagnose human infection. This is also the case with regard to how to reorganise and recover after an incident where dangerous substances have spread. Emergencies or intentional incidents involving chemical, biological and radioactive substances generate great fear and anxiety in addition to causing physical injury and damage. Consequently, the psychological, social and economic impact of such incidents needs to be made clear.

Natural Disasters

Our part of the world has been largely spared natural disasters, but preventive measures must be taken and those incidents that do occur need to be dealt with. Sweden may suffer and be affected by natural disasters and weather events such as forest fires, landslides, avalanches, floods, rising sea levels, storms, extreme precipitation and extreme temperatures. Globally, natural disasters and extreme weather pose a major problem in many areas and Sweden participates in international efforts for the prevention of natural disasters and the management of the consequences in the affected areas.

The gaps in our knowledge and the challenges are numerous as well as complex. In certain areas, basic knowledge is lacking as to the causes and connections regarding the course and effects of natural disasters. Improved models are needed in order to describe causes, events and the consequences that may affect the individual, society and the environment. In some cases, studies have been made in other parts of the world based on existing conditions there, for example, geology and vegetation. Results from such research may require additional data from studies of Swedish conditions.

Methods and tools for risk analysis, forecasting and simulation must be developed in order to better anticipate, prevent and manage natural disasters. Furthermore, methodology and equipment for

surveillance, warning, prevention and management need to be developed. Cost benefit analyses and other support for decisions should be improved in order to assess and prioritise risk mitigation.

Evidence suggests that natural disasters are becoming increasingly severe in pace with climate change and the links between them must be determined and analysed. There are numerous studies and scenarios that examine the progress and consequences of a single natural disaster but what happens if two or more events occur simultaneously or are connected to each other?

While there is a substantial quantity of information available on the natural scientific and technical aspects of natural disasters, often within single scientific disciplines, cross-disciplinary approaches are for the most part lacking. A great deal of knowledge is also needed about social and economic aspects, for example, of consequences or of perception, behaviour and acceptance of measures taken in connection with the risk of natural disasters.

Critical Infrastructure

Society is comprised of a number of complex operations and systems, which individually and as a whole are crucial components in its ability to function, such as the energy and food supply, communications and transport, for example. The impaired function of such operations could have serious consequences not only for people's lives and health, but also for the capacity to safeguard the fundamental values of society.

There are complex variables within the different critical infrastructures that render society even more vulnerable. More information is needed about how various operations and services affect each other and about the implications of these variables. In connection with the deregulation of certain critical infrastructure, private sector entities are providing services and products in these areas. In some cases, ownership and thus accountability has also been transferred to operators outside the country, which has created the need to study changing responsibilities, the effects of this and the collaboration between private and public entities in the area. Disruptions to the infrastructure such as energy, water and sewage systems can affect large sections of society. Consequently, the need exists for improved technologies and methods for monitoring critical facilities. Control, monitoring and admin-

istrative systems may enhance both efficiency and safety, but they also create new vulnerabilities. What might be the consequences for a safe society?

Disruptions to the transportation chain may have far-reaching consequences for infrastructure such as food and medical supplies, emergency medical services and care of the elderly. Research is needed in order to find methods for safer transportation chains and monitoring of transportation at critical nodes such as ports or harbours, borders and airports. A third suggestion for research in the field is the improvement of the potential for the identification of goods.

The medical services are a part of the critical infrastructure that has numerous variables, in relation to the functions of society around it, internal infrastructures and supply systems. Issues regarding ongoing medical operations in the care sector do not lie within the MSB's sphere of responsibility. However, the MSB's role is partly to ensure that there is preparedness for emergency medical services in connection with a serious emergency or crisis and partly to ensure that infrastructure also functions adequately in the event of disruptions to other parts of society. Research is needed into how society should organise its emergency preparedness to maintain emergency medical services during emergencies and crises. The financial system is vital to the capacity of societal operators to maintain their operations. Financial markets have become increasingly global, with the result that the system now must be considered and dealt with globally. What strengths and weaknesses will this entail for societal safety?

Information Security

While the role of information and information management is becoming increasingly important in society, so too, is the significance of creating and maintaining a high level of security in information management. Information security means that sensitive or private information cannot spread at the same time as there is secure access to information that is needed and should be available. In addition, it must be possible to trust the reliability of the information. Information management is enabled, to an increasing extent, by IT and the Internet, creating considerable dependence on technology and related processes for information management and electronic communication. A great number of

organisations, among them operations which constitute critical infrastructure, depend on functioning and often automated information management. This reliance has changed the status of risks, threats and vulnerabilities and consequently, knowledge is vital in order to be able to create robust and reliable systems. Knowledge is also needed in order to be able to detect and prevent intentional attacks by individuals or organisations that use weaknesses in information management for personal gain or in order to cause problems.

Information security encompasses the entire society, and involves more areas than those that are purely technical. Legal and organisational issues are also important in this context. The field is both complex and changeable in its nature, which is why the standard for continuous research into this subject is high.

Programme Area 3
— Prevent, Prepare, Manage and Learn

Programme Area 3 – Prevent, Prepare, Manage and Learn

The research programme's third area is about stakeholders in the fields of public safety, civil protection and emergency preparedness and on the conditions, methods and tools used in the work to enhance public safety, civil protection and emergency preparedness. The area includes the time before, during and following an emergency. Information, management, cooperation and communication constitute some of the pre-conditions for these efforts. Other important areas are applicable methodology and equipment, and the entities having the training and practice required for their assignments. The section begins with an overview of the key issues.

Before, During and After

A large and important proportion of societal safety work is implemented before an emergency or crisis occurs, namely, through prognoses, planning, prevention and preparation. The aim is to avoid emergencies and crises and reduce their consequences, but also to plan and prioritise limited resources. Preventing and preparing for emergencies and crises today are the general issues. What factors are important for successful prevention and harm reduction? How can we design systems, methods and technologies that enable us to avoid risks?

Nevertheless, it is pertinent to study the various elements of societal preparedness, for example, resources, availability, procedures and plans in order to succeed in managing events that do occur. Knowledge is needed about the significance of plans, routines and exercises and how these are used when the worst happens. How might resources and plans be designed to deal with both small, frequent events and new, unknown events with considerable consequences? When an emergency or crisis occurs, knowledge, methods and equipment are needed to rescue and protect people, property and the environment. For example, the injured require care and support and damaged property and environment must be restored. The causes of the incident may need further investigation, while order in society must be maintained and the public supplied with information. In fact, in all these areas, more knowledge is needed. In addition, methods and equipment need to be developed and improved, which applies to the municipalities, and particularly the emergency services, police, hospitals, county administrative boards and several other authorities, and also private entities and individuals.

Comparatively little research has been undertaken into the post-emergency phase. How do we go about restoring the site of an emergency, an organisation or a society? How do society and the individual deal with and come to terms with what has happened? The activities and events which take place before, during and after an emergency or crisis may be seen as a cycle or a recurrent process in which the post-emergency phase may be seen as part of what precedes the next event. How might we enable this cycle to work in such a way so as to learn from what has happened and be better prepared for new emergencies and crises?

Various forms of equipment may be needed before, during and after emergencies and crises. Considerable demands are often made of the equipment. More research is needed to develop equipment and technology that is robust and easy to carry (a large amount of equipment needs to be smaller and lighter) and has high sensitivity. The general aim is that everyone should be able to use available equipment, for example, mobile phones, in emergency and crisis management. Rising costs for manually performing a large number of work assignments means that there is a need for automated solutions. One challenge is to enable different types of equipment, technologies and systems to work together, that is, create interoperability.

Entities, Responsibility and Organisation

Many different entities have a role in the field of public safety, civil protection and emergency preparedness. Consequently, information is needed about their areas of responsibility and obligation, within specialist or geographical areas. There are authorities at a local, regional and national level, some of which are operative while others have an advisory capacity or are concerned with establishing norms. Industry, organisations and the individual too have a responsibility. Cross and multi-disciplinary efforts are required in order to gain an overview of the circumstances relating to responsibilities and obligations, legal conditions, ethical and moral dilemmas. Information is also needed about how these issues are perceived by the entities and how things actually work in practice. The study of individual organisations, their efficiency and suitability for the purpose they serve is also relevant. These studies might be undertaken with regard to aspects such as organisational structure and culture or gender and diversity in order to improve the quality of entities' contributions and working

conditions. Studies are also needed on more randomly organised bodies, consisting of volunteers, for example, which may be formed in the event of an emergency. Voluntary organisations which operate at the site of an emergency or crisis have indeed been the subject of studies in other countries, but not in Sweden or in relation to Swedish conditions. Further knowledge is needed about how we may benefit from and utilise private initiatives, associations and stakeholders in prevention and humanitarian aid work.

In addition, research is needed into the various interpretations of different entities and the way they find meaning in unexpected and extreme situations. This, in other words, is the foundation of how entities operate. Particularly interesting, is the study of the need within these organisations for flexibility and improvisation in crisis management.

Tools for Prevention and Preparedness

Risks, threats and vulnerabilities must be identified and analysed when undertaking prevention and readiness efforts, as well as the consequences that an event may have and the skills that exist for handling the event. This analysis may then form the basis for prioritising, taking measures, planning and creating preparedness. Tools are needed to perform this work in an appropriate way. There is a need to study how various methods are used by different actors at different levels of society, to develop new qualitative and quantitative methods of analysis and assessment and increase the usefulness of those methods. One challenge is to gain an overview of societal risks, threats and vulnerabilities and the ability to respond to, and to eliminate, them. New methods also need to be developed in order to be able to manage complex systems and make syntheses of different entities' analyses and to provide strategic support. Another important issue is that of looking at how, when using these methods, uncertainty is handled in terms of estimated values such as probabilities and consequences.

Tools and methods for prevention and preparedness work, which are appropriate for study, include risk and vulnerability analyses, capacity assessments, contingency planning, simulations and models, scenarios, threat assessments, business intelligence and cost-benefit analyses. To a greater or lesser degree in prevention and preparedness work, risks and threats are valued consciously. Risks, threats and actions are compared with each other. Problems

can arise when factors which cannot be directly measured in terms of economic value, such as life and personal injury, need to be measured and compared. Safety is also contrasted with entirely different goals and factors, which may lead to conflicts relating to objectives. Safety measures must often be weighed against financial and other resources, and also against less tangible values such as environment, ethics and personal integrity and freedom. As an aid to risk assessment, national guideline principles for safety levels need to be drawn up by politicians and central government authorities. Local and regional authorities, companies and other organisations may also experience situations where risks and threats are to be evaluated and compared. This work requires more research into theories and methodologies for risk assessment and risk-related decision-making combined with other aspects. In addition, more evidence relevant to Swedish conditions is needed for analysis.

Management, Collaboration and Decision-making

Management and coordination is required in order to ensure that work within public safety functions as a whole. Within these two areas, decision-making and collaboration are key elements. Management, collaboration and decision-making are significant at all levels of society and in all phases of the management of emergencies and crises. This section describes primarily an operational context, while management at the central level is discussed under *A Safer Society*.

A considerable amount of research has been carried out on management and leadership, for example, in a military context. Management and coordination within civilian crisis management, however, have not been studied to the same extent. It is a challenge In today's multi-organisational system of entities active in the field of public safety, civil protection and emergency preparedness to create effective leadership roles in which people, organisations and technology can interact and where the resources are used efficiently. Studies need to be made of how management actually functions and the impact it has on the results of various measures and operations. In addition, new flexible management concepts need to be conceived which may be adapted to the situation and which involve more than the traditional entities. New forms of management, where it is seen as the management of the network groups, need to be developed which work well in the complex

structure of entities with varying degrees of regional and sector responsibility. There is also a need for a greater knowledge of how the political and management processes at regional and local levels interact with each other in the management of emergencies and crises.

Collaboration in the field of public safety, civil protection and emergency preparedness is a relatively new research area that can be highlighted from several angles and within several scientific disciplines. How do coordination and collaboration work? What are the necessary conditions and success factors? How do groups cooperate in a crisis? Examples of areas that might be studied are collaboration on and among different levels: local, regional, national, EU and international, as well as private/public collaboration and civil/military collaboration.

Decision-making is, as previously mentioned, an important aspect of management and coordination. Studies need to be undertaken as to how decisions are made in emergencies where stress and uncertainty are present. Further knowledge is also needed about the support required by various decision-making management functions. Subsequently, new tools may be developed based on these findings in order to, for example, assess situations and simulate the course of an event.

Management and leadership should also be analysed from the diversity and gender perspectives. We also need more knowledge about the feelings, reactions, understanding and behaviour of leaders and other entities' and how these aspects impact on others.

Information Management

A considerable amount of information is generated before, during and after an event or crisis. There is a demand for research into the substantial challenges of ensuring that all entities have access to the information they need and into interpreting and analysing information in order to gain a sound perception of what is actually going on. For example, what information may be shared and how? How should the information be collated and presented? And how might a reasonable shared view of the situation be gained? These are some of the issues that need to be illuminated from several different angles, and which address and answer questions within technology, behavioural science and social science.

Knowledge of the development of new technologies and new systems is also needed in this area. There are many ways of collecting or generating information. The earlier an emergency or crisis is discovered, the greater the opportunities for its being managed appropriately, hence the importance of detection and early warning. While an event is ongoing, information is constantly being gathered on how it is developing and being managed. One challenge is to analyse and interpret the various and sometimes weak and uncertain signals. Technical research is needed in order to develop, for example, alarm systems, sensors, and analytical and measuring devices which may be used quickly and reliably to identify deviations or to analyse the circumstances surrounding an event. In addition, development is needed of sensor networks, the theory and methods of signal processing and the merger of data from different sensors.

Communication

Information should not only be gathered, collated and analysed; it must also be communicated. Communication is required between societal entities before, during and after emergencies and crises in order for collaboration in preventing and handling a situation.

Information is collected and converted into messages about measures to be taken. More knowledge is needed about how this communication process works within and among organisations and individuals and how it can be made clearer, especially in those emergency situations to which it often applies.

Equally as important as communication between societal entities is that between societal entities operating in the civil protection field on the one hand, and the general public and other entities on the other. Communication is an important part of societal endeavours to maintain and improve safety and there is a need for more knowledge about risks and crises to be communicated. Further information is also needed about how people collect and relate to information in connection with risks and crises and how that information is used and translated into action. In addition, more insight is needed into the attitudes and approaches of various societal entities towards risk communication as a preventive measure. We also need to know more about how organisations currently work with the acquisition, planning and handling of information and about communication about risks and crises. The perspective

of diversity is vital in this context. The media naturally plays an essential role in general crisis awareness, on a national as well as international level. What is the nature of that role? How do media images of crises and disasters correspond to actual events and the processes shaping these images?

Furthermore, studies should integrate the risk and crisis communication of the mass media and those organisations in charge, with the general public's perceptions of the crisis. Which channels distribute information to those involved and how is that communication affected by new channels such as social media?

Knowledge is also required about Sweden's connections with and dependencies on other nations and international organisations with regard to effective management in communicating internationally dispersed threats or serious incidents within and outside the country. In the field of communication, technological research is also needed, in particular, in the development of technology and systems for secure and efficient communications.

Training, Exercises and Learning

An essential but challenging task for many players in the field of public safety, civil protection and emergency preparedness is that of learning from experiences gained at of emergencies and crises and putting that knowledge into practice. Operators need education and training and in some cases practice or exercises. An actor may be anybody from a private individual to a professional services practitioner or organisation and consequently education, training and learning may incorporate numerous perspectives.

In addition, it is important to ascertain how learning from emergencies and crises comes about and what skills and knowledge are important to different stakeholders. More information is needed about how the individual may be a resource in work in the field of threats and risks and how to ensure that the general public possesses basic skills and knowledge about threats and risks and how to avoid or handle emergencies and crises. Professionals operating within the field of public safety, civil protection and emergency preparedness, should essentially analyse how training and exercises are designed today, and if, and how, they may contribute to the development of skills for effective emergency and crisis management. If they do not, how should they be designed? For example, how might simulations and role-play be used in training and exercises?

Research is also needed into the psychological and pedagogical prerequisites for learning, particular in terms of exercise scenarios. The term "exercise" means the development of specific skills and abilities in an actor or system. Exercises are an effective tool for assessing an organisation's ability to manage emergencies and crises. Consequently, the results from the exercises may often raise important questions and input values for different research areas. Until now, exercise methodology has, to a large extent, been based on experience and proven knowledge and only to a minor extent on research results. There is a need for increased knowledge in several areas in order to develop and improve training and exercise activities. For example, information and knowledge are needed about how to make better use of public resources during an exercise and also to highlight the long-term impact of the exercises on society's ability to manage emergencies and crises. Methods are also needed for evaluating the capacity of entities to collaborate during an exercise and the effects of such collaboration.

More information is needed about how organisations can transform their experience and findings into new work practices for the prevention and management of emergencies and crises. For example, how is individual learning from experience transferred to organisational learning? The relationship between organisational learning, systematic safety efforts and good safety culture will also need additional research.

International Humanitarian Operations

Sweden and Swedish entities participate, on request, on international humanitarian operations at disasters and conflicts, which may involve humanitarian relief work and long term prevention or recovery projects. There are a number of factors, including globalisation, that affect how Sweden is expected to act, its capacity for action and how it should act in such a context. In many respects there are similarities between working with national and international efforts, but there are also some areas that are specific to international response operations and which therefore require special research efforts.

Sweden's role varies depending on whether an operation is mounted in Sweden or abroad due to varying conditions of responsibility. Swedish resources are controlled by international demand in the event of an international disaster response.

Different entities are prepared to intervene if necessary, but efforts are seldom planned or coordinated in advance, which is why further knowledge is required of how the coordination of operations may be facilitated and conducted more efficiently.

Nowadays, there is a sound understanding and perception of the demand for international operations and of their direction and nature. However, more knowledge is needed about the effectiveness of different operations. What are the performance results and how are objectives achieved before, during and after an operation? In order to ensure that aid reaches affected in the population those most adversely, more knowledge is needed about the nature of these groups and how operations may be tailored to their needs. This issue needs to be highlighted from the perspective of gender and equality, and the situation of children and people with disabilities.

With regard to humanitarian operation and disaster risk reduction work, the MSB needs more knowledge about phase-out strategies. What is the connection between the phase-out strategy and early recovery? How might such strategies ensure continued sustainable development while benefiting the most vulnerable in society and what factors should dictate the choice of strategy?

International operations are controlled and influenced by various international agreements and national guiding principles; research is needed into how this takes place and how well the operations meet their objectives. This applies, for example, to the role of women and participation in international operations as well as to the relationship with the laws of war (international humanitarian law).

The MSB strives to support disaster-prone countries through risk and vulnerability assessments and the development of national capacities. This work demands continued development of existing methods and models, used successfully in Swedish and European contexts, for use in other geographical and cultural contexts.

Lessons need to be learned from past projects, programmes and efforts implemented for disaster management in order to improve the MSB's support for disaster management. More knowledge is also needed about how to develop the exchange of experience and learning between national and international operations so that they may benefit from each other's expertise and experience.