



LAUREA
UNIVERSITY OF APPLIED SCIENCES
Together we are stronger

Building Organisational Interoperability and Situation Awareness for Crisis Management - The KRIVAT Framework

Koski, Elina

2015 Leppävaara

Laurea University of Applied Sciences
Leppävaara

Building Organisational Interoperability and Situation
Awareness for Crisis Management - The KRIVAT Frame-
work

Elina Koski
Degree Programme in
Security Management
Bachelor's Thesis
November, 2015

Koski, Elina

**Building Organisational Interoperability and Situation Awareness for Crisis Management -
The KRIVAT Framework**

Year	2015	Pages	46
------	------	-------	----

This thesis was written as part of studies in the Degree Programme in Security Management at Laurea University of Applied Sciences. The completion of the thesis was supported by the State Security Networks as the main beneficiary of the results of this thesis and the administrator of the Krivat framework.

The goal of this thesis was to develop the collaboration process within the Krivat framework. Krivat target organisations recognise the need for such an interoperability framework as Krivat is and have even called for such a system to be developed, but are now wary of using the framework. The thesis takes two possible solutions and, by means of an action research and benchmarking, studies their viability in relation to the problem.

The action research studies the Krivat introduction event provided for every new user, where the system and its use is taught to the user. For the research, three introduction events were observed, providing material for development and reflection.

The benchmarking sought to determine if crisis management exercises would be better in increasing the willingness of the participating organisations to collaborate with one another. To this end, a day-long preparedness exercise was observed and a group with extensive exercise experience was surveyed about their positive and negative exercise experiences.

The theory basis reviewed for this thesis provided as many insights for the future development of the framework as the research into the user introductions and exercises. The action research demonstrated the importance of the introduction event to the users, however it made clear that the event must be more engaging. There was originally an intention of creating a set of exercises for the Krivat framework, however this thesis brought home the point that there are many well functioning exercises which could utilise Krivat instead of creating any additional ones.

Keywords interoperability, situation awareness, crisis management, communication, business continuity management, critical infrastructure protection

Koski, Elina

Yhteentoimivuuden ja tilannetietoisuuden kehittäminen kriisinhallintaan - KRIVAT-konsepti

Vuosi 2015 Sivumäärä 46

Tämä opinnäytetyö on kirjoitettu osana opintoja Laurea-ammattikorkeakoulun englanninkielisessä turvallisuusalan koulutusohjelmassa. Työn toimeksiantaja on Suomen Erillisverkot-konserni, joka Krivat-konseptin ylläpitäjänä myös hyöttyy työstä toiminnan kehityksessä.

Tämän työn tavoitteena oli kehittää Krivat-yhteisön sisäistä yhteistoimintaprosessia. Krivatin kohdeorganisaatiot tunnistavat tarpeen Krivatille ja ovat sen myös ilmaisseet eri yhteyksissä, mutta ovat kaikesta huolimatta epäileväisiä konseptin käyttöönotossa. Tämä työ tutkii kahta mahdollista ratkaisua ongelmaan käyttäen toimintatutkimusta ja benchmarkingia tukena.

Toimintatutkimuksella perehdyttiin Krivatin käyttäjäkoulutukseen. Tutkimuksen aikana tarkkailtiin kolmea eri käyttökoulutustapahtumaa, jotka toimivat materiaalina kehitykselle ja pohdinnalle.

Benchmarkingin avulla pyrittiin selvittämään kriisinhallintaharjoitusten mahdollisuuksia toimia osallistujien aktivoijana Krivatin yhteistoiminnassa. Benchmarkingia varten lähetettiin kyselytutkimus valikoidulle ryhmälle heidän onnistuneista harjoituskokemuksistaan, sekä tarkkailtiin päivän kestänyttä harjoitusta.

Opinnäytettä varten tehty teoriakatsaus tarjosi runsaasti oivalluksia Krivatin kehitystä varten, kuten myös työtä varten toteutetut tutkimukset. Toimintatutkimus osoitti käyttäjäkoulutuksen olevan tärkeä vaihe Krivatin käyttöönotossa, mutta osoitti myös että tapahtuman on oltava käyttäjiä aktivoivampi ja osallistavampi. Benchmarkingin perusteella todettiin että Krivatia varten ei kannata kehittää omaa erillistä harjoitussarjaa, sillä monet jo olemassa olevat harjoitukset voisivat käyttää Krivatia työkalunaan.

Keywords interoperability, situation awareness, crisis management, communication, business continuity management, critical infrastructure protection

List of abbreviations

BCM	Business continuity management
CI	Critical infrastructure
CIP	Critical infrastructure protection
DSO	Distribution system operator
ERVE	Suomen Erillisverkot (State Security Networks)
KRIVAT	Kriittisen infrastruktuurin varautumisen tehostaminen
NESA	National Emergency Supply Agency
SA	Situation awareness
SSA	Shared situation awareness

Table of contents

1	Introduction	7
2	Key concepts and theoretical framework.....	9
2.1	Key concepts	9
2.2	Interoperability	10
2.3	Crisis communication	11
2.4	Crisis management	12
2.5	Shared situation awareness (SSA)	14
2.6	Business Continuity Management (BCM).....	15
2.7	Critical infrastructure protection (CIP)	17
2.8	Crisis management exercises.....	18
3	Research method.....	19
3.1	Research questions.....	19
3.2	Research methods.....	20
3.3	Implementation of action research	21
3.4	Implementation of benchmarking	22
4	Results	23
4.1	Action research	23
4.1.1	Observations	23
4.1.2	Reflection.....	26
4.2	Benchmarking.....	27
4.2.1	Survey questions.....	27
4.2.2	Survey results	29
4.2.3	Preparedness exercise observations	33
4.3	Scientific validity.....	35
5	Conclusions.....	36
	References	40
	Figures	43
	Tables	44
	Appendices	45

1 Introduction

For a number of years, the need for a communications structure for disturbance management and situation awareness between organisations has been recognised by many different parties. The Safety Investigation Authority report on the summer storms of 2010 could not have made the point better:

“Concerning the 2010 storms, nearly all officials, ICT companies, and electricity providers have in their suggested developments arrived at the conclusion that all those involved in the management of the situation should have at their disposal a wide-ranging national situation awareness comprised of information from officials.” (Safety Investigation Authority, 2010)

At the initiative of the National Emergency Supply Agency (NESA), several critical infrastructure (CI) operators devised the KRIVAT concept, the aim of which is to facilitate communication and co-operation of organisations during a major disturbance in order to speed up the recovery process and minimize the damages. A community of CI operators, their support organisations and rescue services was created around the concept, and the management of the concept was given to Suomen Erillisverkot Oy (ERVE), a state-owned communications operator. At the time of writing this thesis, the community comprised of six organisations with negotiations to include several more organisations ongoing.

Krivat stands for “KRIittisen Infrastruktuurin VARautumisen Tehostaminen” in Finnish, loosely translated to “Enhancing the Preparedness of Critical Infrastructure” in English. It is a framework for action, the main purpose of which is to enhance and supplement the existing preparedness and disturbance management activities of critical infrastructure operators during major disturbances. (Nortio, 2015)

The concept contains a community comprised of CI operators and their support organisations, a system for real-time information exchange between the organisations and support services organised by ERVE. The aim of the concept is to reduce damages incurred from major disturbances by on one hand aiding in preparing for the disturbances, and on the other hand by speeding up the recovery process once the disturbance has occurred. The advantages of Krivat also include better co-ordination of resources between organisations, increased information-sharing between organisations, and better situation awareness. (Nortio, 2015)

It is not, however, enough to devise a concept, introduce it to organizations and simply leave everything to chance. The member organisations of the Krivat community have their own ways of managing a major disturbance that need to be navigated and fitted to work together

for the concept to bring its participants the benefits it should. Even though ERVE serves as the administrator of the community, it has no authority to force any of the organisations into taking any action or doing anything in a particular way. Since the concept is a novel approach to major disturbance management, the need to gather experiences and establish guidelines is dire.

The aim of this thesis is, by discussing the problems related to bringing so many diverse organisations together to work on managing a disturbance in operations, to develop the collaboration process of the Krivat framework from what it is now to where participating organisations would not hesitate to use the tools provided by Krivat and to share information with one another. The problems this thesis deals with are centered around the larger themes of shared situational awareness, interoperability, communication and crisis management.

The next chapter introduces the key concepts and theoretical framework for this thesis starting with definition of the none-theoretical concepts and moving on to the larger issues involving more theory. Chapter three discusses the research conducted for this thesis and chapter four describes the research results. The conclusions drawn from the research are discussed in the final, fifth chapter.

2 Key concepts and theoretical framework

The Krivat concept is a unique and only seemingly simple approach to managing crisis situations and this also reflects on the theoretical framework of this thesis. This chapter describes the main larger concepts used in this thesis as well as the theories surrounding the issue.

2.1 Key concepts

One of the most central concepts in this thesis is the concept of major disturbance, and especially how the term is used. This concept is the term used for those situations Krivat is especially planned for and where organisations would most need Krivat. The positioning of the framework is illustrated below in figure 1.

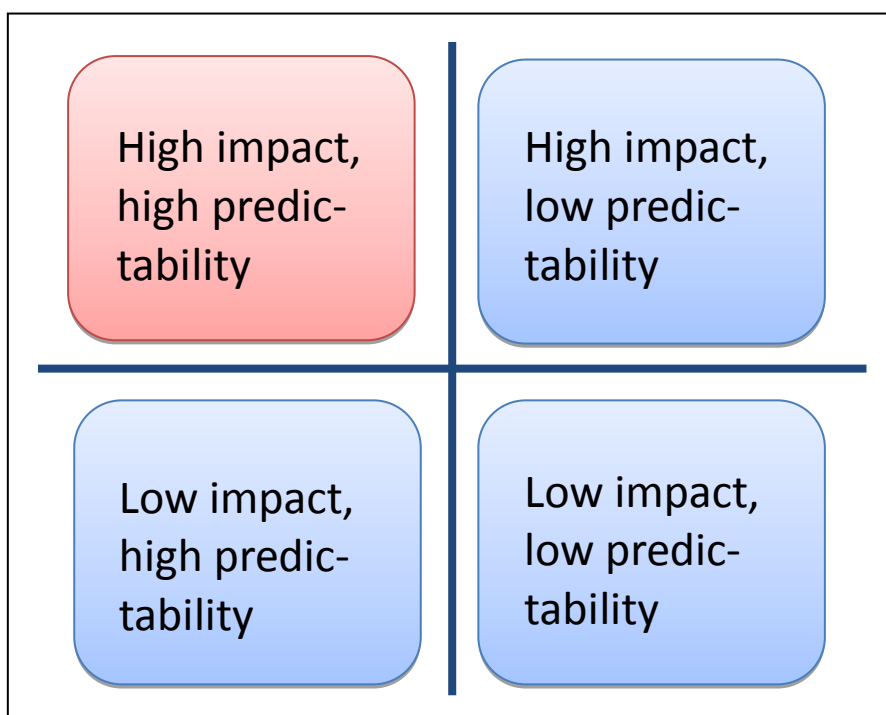


Figure 1: Positioning of Krivat

The term major disturbance is so far an exclusively Finnish concept. The term is a direct translation from Finnish, and based on the literature review conducted for this thesis, it does not show up in any international papers or documents, unless one or more of the authors is Finnish.

So far, the most comprehensive definition for the term comes from Strandén et al. (2014) and their article on influences of major disturbances on electricity distribution system operators (DSOs), which is not to say that the definition would necessarily be the best. While the defini-

tion offered is much improved from the mostly technical definitions that do not concern with the criticality of the situation (also noted in the article cited), the definition Strandén et al. offer is still too much focused on the electricity sector. According to the article, a major disturbance is:

“--long lasting and/or a widespread interruption in the supply of electric power during which the fire and rescue services and one or more other public actor (municipality, police, etc.) need, in addition to the distribution system operator (DSO) to start implementing measures for reducing possible severe consequences to people and property.” (Strandén et al., 2014)

There is an annoying amount of semantic ambiguity related to the terminology in the literature. Some sources use ‘crisis’ and ‘disaster’ interchangeably (eg. Seppänen, 2015), others have very carefully defined several different terms for types of disturbances to operations (eg. Kyrölä, 2010). Making sense of this hodge-podge of concepts could be a thesis in itself, it turns out. This thesis does use the term ‘crisis’ interchangeably with ‘major disturbance’ where it discusses issues such as crisis management and communication. The term ‘crisis’ is defined and discussed in a later section of this chapter.

Another central concept is multi-organisation, used in the context of multi-organisation disturbance management, or multi-organisation crisis response if one is inclined to use the more recognised term. By multi-organisation crisis management this thesis means a crisis management response where several mainly private organisations from several sectors and jurisdictions cooperate to respond to a major disturbance. A typical such response might include three electricity DSOs, two communications operators, and fire and rescue services from two municipalities.

Multi-organisation responses to disturbances require at least a rudimentary level of interoperability. Interoperability and the issues relating to communication are discussed in the next section.

2.2 Interoperability

Interoperability lies at the heart of the Krivat framework. The term has multiple definitions, some more technical than others, but this thesis uses the ACPO (Association of Chief Police Officers) definition quoted by Pollock and Coles (2015), which specifically defines interoperability in the context of multi-organisation cooperation as “the capability of organisations or discrete parts of the same organisation to exchange operational information and to use it to

inform their decision making.” There are two subdivisions to interoperability, technical and organisational, with Krivat representing the organisational side.

As far as interoperability frameworks go, Krivat is a text book example of one. According to Pollock and Coles, an interoperability framework has a set of rules and agreements to describe the interactions between the organisations. Such rules and agreements exist in the Krivat framework and they concern information exchange and escalation of operations. As the framework develops, there are bound to be new rules for interaction to keep everything manageable.

The capability to exchange operational information between organisations does not come naturally to organisations. In the context of Krivat, many of the member organisations are competitors under normal circumstances, and therefore justifiably cautious in what they publish and to whom. The Competition Act 948/2011 (Finland, 2011) prohibits companies from entering into contracts and joint ventures that would prohibit, restrict or skew competition, including standardising procedures.

As the concept was being formed, one of the issues that was thoroughly investigated was if Krivat would pose such a restriction on competition. As a result, all member organisations sign a Mutual Aid Agreement which, among other things, specifies rules for the information exchange between organisations and how the information received from Krivat can be treated. In order to make these rules as clear as possible, Krivat information exchange uses the Traffic Light Protocol (TLP) in classifying information in those situations when the information is not public. Use of the TLP and the signing of the MAA also tackle another obstacle to interoperability, namely issues concerning classified data and trust. (Pollock & Coles, 2015)

One of the issues that must also be considered is the extent of the interoperability between organisations. What is the minimum level required for a framework such as Krivat to function, what is the ideal, and what is too much? As the framework develops, this issue will likely be considered alongside others.

2.3 Crisis communication

Organisational communication and, more specifically, crisis communication has been researched thoroughly over the years. In this thesis, crisis communication is used to refer to the communication of organisations involved in the management of the crisis situation. This thesis does not consider intra-organisational communication during a crisis nor communication to media or other stakeholders.

Osmo A. Wiio stated in his laws of human communication that communication usually fails, except by accident. He went on to state that if the message could be interpreted in different ways, it will most likely be interpreted in the way that will cause the most damage. His fourth law of human communication is perhaps the most significant for the Krivat concept: the more communication there is, the more it will fail. The significance for Krivat being here that the more information is exchanged between organisations, the more likely it is that something can, and therefore will, go wrong. (Wiio, cited in Merimaa, 2008)

Responsibilities for communication are also an issue that cause problems. Depending on the organisation, communication can be seen as the responsibility of specific individuals, or a joint responsibility. However, if no one is named as responsible for communication, it becomes more likely that no one will communicate anything. It is seen as the job of 'someone else', or thought that 'someone will take care of this'. During a multi-organisation response to a disturbance, these responsibilities can get even more confused and impact the effect of the response. (Juholin, 2006)

Communication, especially in a multi-organistaion environment, is not a one directional process where messages go from one direction to another and are immediately understood by the receipient. There are several theories and models related to communications and sense-making of the messages. Individuals attach different meanings to different messages depending on their backgrounds and their surroundings, and therefore the lack of common terminology is often an issue. This point has also implications for shared situation awareness, discussed more in depth in a later chapter. (Juholin, 2006)

Communication and information exchange have been identified as one of the defining characteristics of interoperability. Since they have an integral part to play in creating interoperability, it stands to reason also that if these are not achieved, they become barriers to interoperability. Success of communication is also one determining factor in the overall success of a crisis response. The benchmarking research conducted for this thesis surveys preparedness exercises in light of, among other things, the characteristics of interoperability. (Pollock & Coles, 2015)

2.4 Crisis management

In dictionary terms, crisis management is defined as "a set of procedures applied in handling, containment, and resolution of an emergency in planned and coordinated steps" (Business Dictionary, 2015). Characteristic to crisis management are the need to make decisions quickly and reactivity; crisis management activities usually occur after an incident. Pearson and Clair (1998) define organisational crisis management as "a systematic attempt by organizational

members with external stakeholders to avert crises or to effectively manage those that do occur.”

Pearson and Clair define an organisational crisis as “a low-probability, high-impact event that threatens the viability of the organization and is characterized by ambiguity of cause, effect, and means of resolution, as well as by a belief that decision must be made swiftly.” (Pearson & Clair, 1998) Comparing this definition to the positioning of Krivat illustrated in figure 1, we see that strictly according to this definition, situations for which the Krivat was developed do not fall under the heading ‘crisis’. Chapter 2.1 introduces the concept of major disturbance, which is used much in Finnish contingency planning discourse.

Successful crisis management efforts enable organizations to sustain or resume their operations, minimise losses to stakeholders, and lead to meaningful learning to manage future incidents. In the context of Krivat, these efforts are undertaken together by several organisations from various sectors, for which reason the term multi-organisational crisis management is used. (Pearson & Clair, 1998)

The cycle of Krivat activities has often been described as a figure eight with one cycle of actions during disturbances and one cycle during preparation. The first cycle would be thought of as the crisis management cycle, where the community reacts together to a disruptive event as quickly and as efficiently as it can, and the second cycle is the so-called CIP cycle, where the lines between the organisations are again more clearly defined and organisations plan for the next event. Critical infrastructure protection (CIP) is discussed in more detail in chapter 2.7.

Boin and McConnell (2007) argue that traditional crisis management responses and contingency planning approaches are very limited when it comes to critical infrastructure breakdowns. They criticize the prevention aspect of crisis management as ineffective, since its success relies on knowledge and understanding of the source and dynamics of the threats. Contingency planning can be effective to a point, however in many cases can cause overconfidence.

Harrald (2006) argued that discipline and agility must both be ensured whenever designing organizational systems or software for emergency response. He identified three themes describing the essential elements of response to extreme events. Harrald also named critical success factors, which are the key areas of activity where success is vital for the end result to be successful. One of his critical success factors is in the area of initial reaction and mobilization and calls for “situational awareness” being “obtained and shared across a distributed organisational network”. Pollock and Coles (2015) mention shared situation awareness as one

element on which effective response and collaboration depend on, and which is discussed in the next section.

2.5 Shared situation awareness (SSA)

MacFarlane and Leigh (2014) define situational awareness (SA) as “the state of the individual and/or collective knowledge relating to past and current events, their implications, and potential future developments.” Simply put, they present SSA as the things that should be commonly understood by all those involved in a situation, so that the collective response will be swift and effective.

Harrald and Jefferson present this widely accepted definition by Endsley for situational awareness: “-- the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future.” (Endsley, cited in Harrald & Jefferson, 2007) They point out that situational awareness is more than just a “correct perception of reality”, it is “the correct perception of the relevant elements of the current reality necessary for correct, protective, tactical, and strategic response.”

The most widely accepted model of SA divides it into three levels: perception, comprehension and projection. Level 1 SA is the basic information that a person needs to function in their work. It does not require any additional mental processing. Level 2 requires some processing and is an evaluation of the current situation. To attain level 2 SA a person needs, in addition to the basic knowledges needed for level 1 SA, the ability to evaluate the magnitude of the incident, the reason behind the incident and its relation to other incidents. Level 3 SA is the highest level of SA, and requires mental processing and an ability to estimate future events based on the current situation. (Endsley, 2015; Rummukainen et al. 2015)

There are a number of problems associated with shared situational awareness (SSA) that have to do with the interpretation of the data, especially as it concerns semantic meaning, perception of information, implications and data quality. Since a significant part of attaining SA has to do with interpretation of data, it becomes plain how different meanings attached to the data or mismatched terminology can be an issue. (Harrald & Jefferson, 2007)

In the case of Krivat, the most pressing concerns are those relating to data quality, perception of information and the implications associated with the data. Krivat provides users much automated data from various sources, however without a way to ensure the timeliness and completeness of the data, the content becomes meaningless. This is, however, a technical concern, and therefore manageable with improvements to the actual system to for example

time stamp the data. Perception of information and the implications that the users associate with the data are more difficult.

The Krivat community is very heterogeneous, meaning that it is likely the various recipients can interpret the data provided in various ways. Based on their backgrounds, experiences and the surrounding organisation, they may also have different implications and requirements for future action. (Harrald & Jefferson, 2007)

MacFarlane and Leigh (2014) also recognise the difficulty related to interpretation of data. They also point out problems such as teams making incorrect assumptions about the capabilities of other teams, or expertise not being made available to the joint effort.

Exercises are one way of potentially bridging the gaps in information perception and implications between the different organisations. Exercises might also be a way to drive home the point that since not everyone shares the same terminology, concepts or even signs and symbols, it pays to be careful with choice of words, to challenge assumed meanings and to check if the message is being understood.

2.6 Business Continuity Management (BCM)

The aim of BCM activities is to enable the organisation to prepare for and cope with emergencies that affect its operative capabilities. In essence, it is about identifying what is essential for your organisation and then making plans in case something happens to those essential parts.

Stuart Hotchkiss (2010) refers to BCM as the management of the different steps of business continuity. This entails regular review of the business impacts and the risks, designing procedures or updating existing ones in light of changed risks or necessary resources, regular staff training and communicating with the staff, regular testing of plans and regular audits. Having planning without management leads, according to Hotchkiss, to outdated plans that fail more often than not.

The BCM lifecycle begins with the production of two documents: a document to “express the strategic intent of a company to include continuity in its regulatory capabilities or as some kind of competitive differentiator” (Hotchkiss, 2010, 6) and a BCM policy.

Hotchkiss presents a BCM lifecycle with eight steps, with governance at the centre. The process begins with a business impact analysis (BIA) to understand the organisation and the functions which have the highest impact on the operation of the organisation. After a BIA, a

threat analysis is conducted for a view of the threats and current countermeasures. Third step is risk assessment to further analyse the risks represented by the threats. Fourth, based on the potential risks, a set of scenarios is designed. Fifth step is to then document procedures to counter the risk scenarios. Sixth, these procedures must be tested in order to determine their efficacy. Seventh, as a result of the testing, is to update capabilities to match needs, and finally, these capabilities should be audited, leading to a new BIA and corrective action. This cycle is illustrated in the figure below.

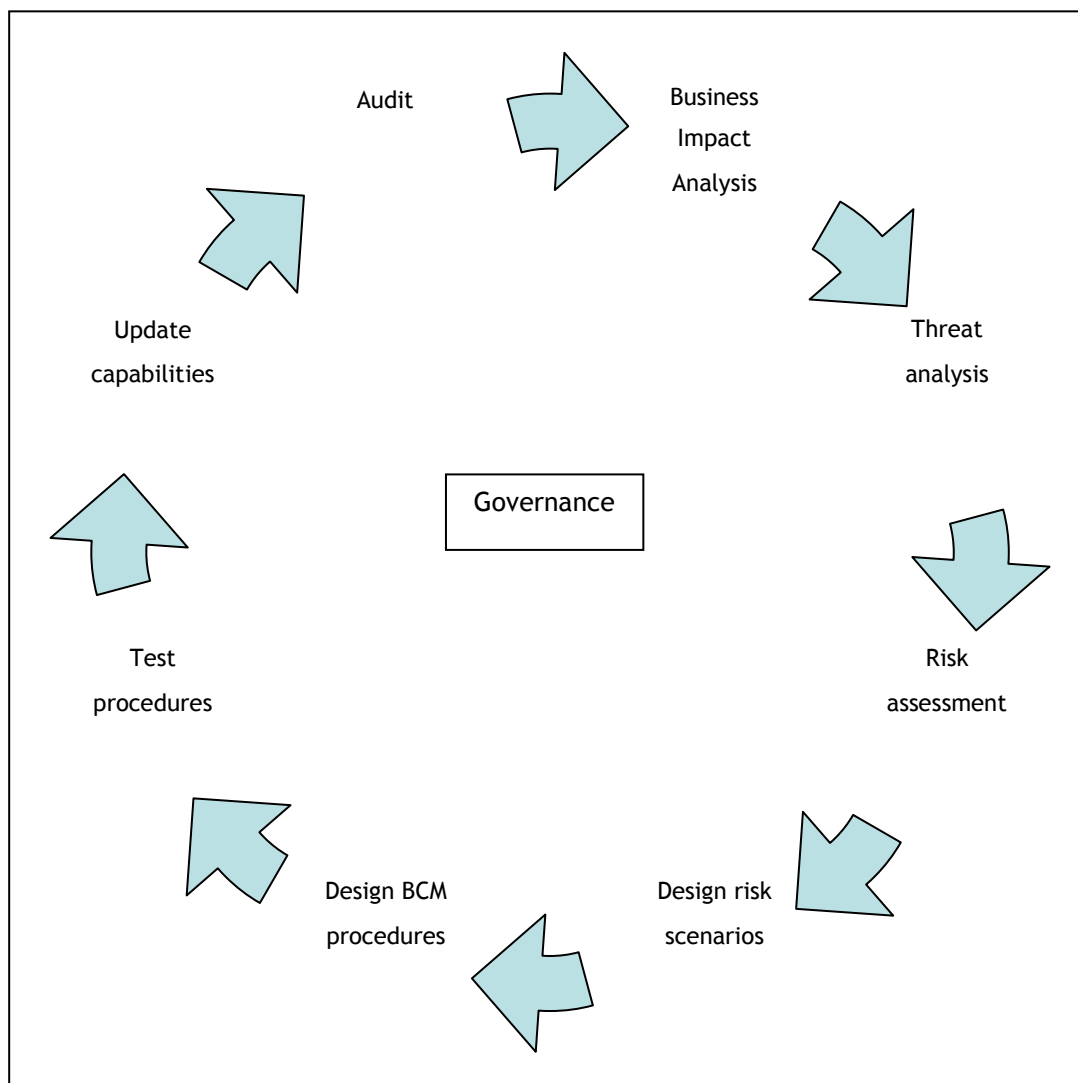


Figure 2: The BCM lifecycle (Hotchkiss 2010, 7)

Joining the Krivat community is not meant as a replacement for the BCM activities of the organisation. It is also not a channel for the companies to outsource their continuity activities. One condition for the organisations looking to join the community is that they have the ability to cope with smaller scale (low impact and low or high predictability, see Fig. 1) situations on their own. Krivat is useful to an organisation only when it knows what it needs to protect, what its priorities are and how it usually goes about protecting those assets.

2.7 Critical infrastructure protection (CIP)

In general terms, critical infrastructure (CI) comprises both the physical structures and the services considered to vital to the continued functioning of the society. In order to protect these, the individual critical areas must be identified and secured, while at the same time keeping in mind the functionality of the entire infrastructure. (Hagelstam, 2005)

In Finland, CI has been divided into seven sectors: energy production, transmission and distribution networks, data-communication systems, networks and services, financial services, transport and logistics, water supply, construction and maintenance of infrastructure, and waste management in special circumstances. (NESA a, 2013)

According to Hagelstam, there are three dimensions to CIP, which need to be balanced: political, technical and economical. The political dimension consists of the national legislation and national security needs and the international co-operation around these needs. The aim is to arrive at similar solutions that would enable co-operation between countries with correspondingly similar needs. Countries with shared critical infrastructure benefit from consistent legislation and security policies.

The economical dimension consists of the companies and other financial actors responsible for building and maintaining critical infrastructure, and which operate according to their economic interests. The private sector has a very strong ownership of the CI structures and services in Finland, which leads to the economical dimension of CIP having more importance. Companies operate for profit, and therefore supporting their operation with public funds would distort the operating of the market. Companies operating critical infrastructure are engaged in competition, not in charity.

The technical dimension consists of the advancement and utilization of technical solutions. All those actions and solutions that governments and organisations take in practice to protect their CI fall into this domain.

In Finland, the businesses have always been an active participant in preparedness and protection of critical infrastructures through Public-Private Partnerships (PPP). According to the PPP Knowledge Lab, a PPP is “a long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration is linked to performance.” (NESA b, 2013; PPP Knowledge Lab, 2015)

The Krivat concept is a prime example of a CIP solution balancing all three dimensions. For one, it takes advantage of the available technology to offer organisations a secure communications solution for dire circumstances. The concept and the technology utilized are also constantly developed to maintain the high standard necessary. The costs for the maintenance and use of the system have been equally divided among the participants, and the legal agreements written for the purpose take into account market laws. The current political atmosphere supports the ideas of cost-effectiveness, best practices and mutual aid across municipalities that are at the core of the concept.

2.8 Crisis management exercises

Crisis management exercises are events with managed and goal-oriented activities taking the form of seminars, workshops, syndicate progressives, hypotheticals, drills, functional exercises, field exercises, or some combination of these. The appropriate style of exercise is chosen based on the aim, objectives and scope of the exercise, however factors such as training needs, budget and availability of participants may also have an influence. (AEMI, 2012)

Crisis management exercises have generally been thought to have several benefits to organisations. Exercises are thought to develop different skills relevant to handling crises, they can test the readiness and the procedures of the organisation, the participants have a chance to meet and form contacts that can help in a crisis situation, and exercises can lead to the discovery of critical deficiencies in the systems of the organisation. (Ingemarsdotter & Trané, 2013)

The AEMI handbook “Managing Exercises” makes a rather bold statement when it asserts that “the success of an exercise depends on whether a structured approach has been adopted.” This would imply that, as long as the exercise is planned and conducted according to a structured principle, it will be successful. What actually constitutes a success is not made clear. Is it an exercise that has simply fulfilled its aim? And on the other hand, is an exercise that has not fulfilled its aim just a waste of time and other resources?

Relatively little research has been done on the usefulness and actual benefits of exercises. Such research has, however, important implications for anyone wishing to plan and conduct a useful exercise. Berlin and Carlström (2015) found in their study of perceptions of usefulness and learning in collaboration exercises that “learning during collaboration does not -- fully prepare employees for actual emergency work”. According to their findings, a fairly large amount of respondents felt that the exercises were inconsistent with their normal work. If the aim of the exercise is to test procedures or simply drill operations, an exercise which has little to do with how things normally work is not a successful exercise, no matter how structured the approach to it has been.

3 Research method

This thesis utilizes two research methods to achieve three main objectives. This chapter describes first the research questions and the objectives of the thesis, then the methods used to answer the questions and finally the implementation. The results are in their own chapter, following this.

3.1 Research questions

The main objective of this thesis is a development goal to find ways to facilitate interoperability between organisations participating in the Krivat framework so that they would not hesitate to use the tools offered by the concept. To reach this goal one of the issues that must be considered is communications and collaboration in multi-organisation responses, which have been discussed in the theoretical framework.

Based on the available literature, it was determined that interoperability has certain requirements which, if not fulfilled, become barriers to interoperability. This formed the basis for the main research question:

1. How to facilitate interoperability requirements in Krivat?

Two secondary questions were also formed:

2. How effective is a user introduction as a way to facilitate interoperability?
3. What kind of an exercise would be the most useful as a facilitator of interoperability.

Since the Krivat framework is a unique and new solution to disturbance management, there are, at least in theory, no existing comparative methods to unlearn. In practice, every organisation has their own previous ways of coping with disturbances, therefore the user introduc-

tion must be an attitude adjusting event as well as a way to teach new users how the system works. The effect of the user introductions was researched using the action research method, with three Krivat user introduction events as material.

On the other hand, literature would also suggest that crisis management or preparedness exercises could be an effective method to teach organisations to collaborate during a disturbance response. This question was researched by benchmarking successful and unsuccessful exercise experiences.

The research methods as well as the reasons for choosing those methods are clarified in more detail in the following section.

3.2 Research methods

The primary research method used in this thesis was action research, due to the active role this research method allows for the researcher and its focus on practical applications. This method was used to develop the information exchange between Krivat community members and to research the elements that could aid in facilitating open communication and shared situation awareness between organisations. Choosing action research as the primary method has also the added benefit of allowing for more control in terms of gaining meaningful results, in that by means of intervention and observation the research would yield meaningful data in any case.

The aim of action research is to change things during the course of the research process and to get more exact knowledge about specific situations. Development of new skills, approaches or solutions to problems is at the core of this method, and the researcher intervenes actively in real-life events and considers the effects of the intervention. (Anttila, 2007)

Action research has a cyclical nature, and one research project usually runs through two cycles. The illustration below shows the process as it runs from the initial planning phase through action, observation and reflection to a new, revised planning phase, which initiates the second cycle of the research. (Anttila, 2007)

A secondary research method utilized in this thesis is benchmarking. This method is used in this thesis to determine the types of structures or elements that would be most beneficial for the Krivat community to foster cooperation and interoperability.

Benchmarking is a process for obtaining a measure of what is the best performance being achieved. The focus in benchmarking is on best practices and continuous improvement. In

business environment, benchmarking is mainly used for achieving competitive advantage by identifying best practices from other organisations and implementing that knowledge to fix gaps in the own processes of the organization. (Stroud, 2015)

3.3 Implementation of action research

As the intervention for the action research, the Krivat user introduction was modified to include new elements that were determined by the available literature and the previous experiences with the introductions of the researcher herself.

Every new user of the Krivat system receives an introduction to the system and the concept in general, as organized by ERVE. As an intervention for the action research, a short discussion exercise was added to the introduction to activate the users and to encourage the users to think about how the system is useful to their goals during a major disturbance situation and what they could achieve by making effective use of the system. This exercise was conducted and observed by the researcher.

This type of intervention serves two objectives. For one, it provides a way to influence the participants to consider Krivat as a tool to enable effective management of a complicated situation, and to activate the participants to think about the system in the context of their own working environment and how they can make the best use of the system. It would also bring out any shortcomings the participants might have about information exchange or the cooperative process of the Krivat system in general. Second, this intervention type also demonstrates the viability of one type of an exercise for the Krivat community.

The modified introduction was carried out in two organisations. The scenario used in the exercise was modified for each organization. The report on the summer storms of 2010 by the Safety Investigation Authority was used as source material for the scenarios.

The starting point for the exercise was a situation where the organization learns of an approaching storm. They were asked to consider the situation as they usually experience it, what has to happen at their organisation at every stage. After considering the current situation, they were asked to consider where they could use Krivat to help manage the situation.

The situation then escalated through the stages of the crisis, where at each stage the participants had a few minutes to discuss the situation, what should happen and how Krivat could help in the management of that stage of the disturbance.

3.4 Implementation of benchmarking

For benchmarking the researcher observed the regional preparedness exercise of Southern Finland preparedness committee, conducted on 5 November 2015 in Santahamina. Additional data was gathered by surveying a selected group on their experiences regarding crisis management exercises, focusing on those experiences they considered the most successful.

The survey consisted of six questions. First, the responders were asked to think of two to three preparedness or crisis management exercises which they considered successful experiences. They were asked to give a general description of these, consisting of scope, duration, aims, and the type of the exercise. They were then asked to in their own words describe what made these exercises successful.

To determine how these exercises could have affected interoperability, the respondents were then asked to rate their positive experiences as a whole on a likert scale. They were asked how they thought the exercises had improved or clarified the following factors, which have been identified as characteristic to interoperability or problematic to it if they are lacking: trust, collaboration, communication and information exchange, clarity of superordinate goals, task interdependence, common operational picture, organisational structure in a multi-organisation response, and collective accountability. (Pollock & Coles, 2015)

After answering questions regarding their positive exercise experiences, the respondents were asked to answer similar questions regarding exercises that they considered unsuccessful. They were first asked to briefly describe the exercises (scope, duration, aims, type or exercise) and then to in their own words describe why they considered these exercises unsuccessful.

As with the positive experiences, they were asked to rate how they thought these unsuccessful exercises clarified or improved the interoperability characteristics. Even though the subjective experience of the participants may have been that these exercises were unsuccessful, it is possible that they still had an effect on these characteristics.

The survey was sent to six participants with extensive experience as participants in different types of preparedness or crisis management exercises. Although five of the six participants currently work for ERVE, all of them have varied backgrounds from different organisations both in the public and private sectors.

The survey data was gathered using SurveyMonkey. SurveyMonkey allows for all the answers of individual participants to be viewed together, thereby enabling the linking of specific answers together.

4 Results

This chapter describes the results of the action research and the benchmarking and discusses the scientific validity of the research. The different research efforts focused on different aspects of the concept, but to summarize the results, the action research yielded useful data for the development of Krivat training and the benchmarking, on the other hand, resulted in ideas for conducting larger exercises with the Krivat community.

4.1 Action research

The intervention for the action research was initially supposed to be carried out three times, once in two different organisations and a second round in one of the organisations, however the Valio storm of 2 October 2015 provided the researcher an opportunity to gather data based on a real situation. The scenario used in the intervention was slightly modified for the second cycle, based on the experiences and feedback from the first cycle, experiences from Valio storm and additional learning by the researcher.

4.1.1 Observations

Observations from the first intervention cycle are very much a case of “you have to start somewhere”. This was the first time the Krivat introduction had been conducted in this manner, so it established a baseline in that respect. It was also the first time the researcher attempted her hand at scenario formation for any kind of management exercise. The following chart lists the observations from the first cycle intervention at Organisation A (a telecommunications operator).

Number	Observation	Notes
Observation 1	Having slides on one screen and live system on other simultaneously a good solution.	Prevents mix-ups and confusion due to having to change feeds.
Observation 2	General atmosphere seemed conducive to learning.	The introduction was arranged for a day when the staff had a general training day.
Observation 3	KRIVAT introduction was the last item of the day, how much did this influence the discussions etc.?	Second cycle intervention has been scheduled as the first item on a later general staff training day.
Observation 4	The senior staff members spoke the most.	The senior staff members kept the discussion going. One of the staff members had been involved with development of the concept and was able to explain many things in terms of relevance to the organization.
Observation 5	Scenario had some key values that caused discussion, however the general flow of discussion was slow.	Only two or three participants actively taking part in the discussion, not taking much stand in effectiveness of the system.
Observation 6	Due to unfamiliarity with the ways of the organization the researcher could not stimulate the discussion much.	Some insights were gained from this intervention.
Observation 7	Was the operative staff untalkative because they were expecting the senior staff members to speak or because they had nothing to say on the subject?	Consideration for second cycle intervention.
Observation 8	Scenario needs to be amended for the second cycle at this organization.	Consider to what extent should the scenario be amended for the first cycle intervention at the second organization.

Table 1: Observations from first cycle intervention at Organisation A

After the introduction, it was observed that for a while Organisation A consistently has the largest amount of logged-in users (six out of 18 for that organization) in Krivat. During the storm response to Valio on 2 October, Organisation A also actively made use of the Krivat services available so far. Before the storm the organization requested additional usernames to be added for their personnel.

Management staff at Organisation A has been active in promoting and developing Krivat and this undoubtedly has a effect on the positive response of the operative staff.

The second cycle intervention was conducted roughly a month after the first cycle at the same organisation. Between the cycles there has been one incident that can be classified as a major disturbance and where Krivat was used as a tool, also at Organisation A. The staff participating in the training had not received any prior Krivat training, aside from two participants. There were nine participants at the second training event. The table below lists the observations and notes from the event.

Number	Observation	Notes
Observation 1	General atmosphere of the event was more discussion-oriented.	However there was not enough real interaction between participants, the discussion was mostly dialogue between “lecturer” and one participant. There were more questions from the participants.
Observation 2	Slides had been modified based on the experiences from the previous training event and other experience of the “lecturer”	Scenario remained the same aside from some minor adjustments to discussion times to prevent awkward silences.
Observation 3	Discussion about the scenario had to be steered by the “lecturer”, with comments such as: “From what I’ve seen, this could be helpful because...”	The participants who had participated in the previous training event made it clear they would not speak here, forcing the other participants to speak up.

Observation 4	The refusal of those who had participated in the previous event to “bail out” the others during the scenario discussion helped to generate conversation.	The scenario exercise seemed somewhat more successful this time due to the slightly livelier exchange of thoughts.
---------------	--	--

Table 2: Observations from the second-cycle intervention at Organisation A

4.1.2 Reflection

The active positive attitude of the senior staff members at Organisation A is undoubtedly responsible for the active use of Krivat at the organization. Numerous studies have shown the positive correlation between staff attitudes towards a change and management approval and investment.

During the response to Valio storm none of the organisations involved demonstrated any particular willingness to volunteer any extra information to one another or to co-operate, aside from the automated disruption information, however one recently joined organisation (a rescue department) utilised the system to specifically request additional information from one of the information providers. As the user base grows, any such interoperability issues should become more clear, if they exist.

Since the size and reach of the system so far is limited, it is also difficult to estimate if the use of the Krivat system was particularly successful in that the users would have known how to effectively use the data and the communications system during the response. Those organisations that have used the system for longest do demonstrate a willingness to consider and try different applications for the system.

Based on these observations, one could argue that using the Krivat introduction as a means to ingrain the idea of interoperability and information exchange into the users could be very effective. In order to make the introduction more concrete and tie the use of the system into the activities of the user organisation, less time should be spent on the features of the system and more on the application.

The observations detailed above and the experiences from the Valio storm were used to amend the scenario and the training materials for the second cycle intervention at Organisation A. The changes included more emphasis on the information exchange rules with more concrete examples.

Between the first cycle and the second cycle interventions, the researcher also participated in a training event focusing on presentation and training skills. The materials for the second cycle intervention were also amended based on the skills learned at this event. If the user introduction is as useful a tool in facilitating not only learning a new system but also as an attitude adjustor, then any improvements in the material or in the delivery of the introduction itself can only help in getting the message across.

4.2 Benchmarking

The benchmarking effort was conducted in two parts: by observation and by survey. This section describes the results gained from the observations and the survey.

4.2.1 Survey questions

The aim of the survey was to gather experiences of crisis management exercises, focusing on what made a particular exercise experience successful or unsuccessful in the opinion of the surveyed. In addition to this, the survey asked the participants to rate how they saw these exercises improve or clarify the factors that have been found to be characteristic to interoperability.

The aim was to establish whether it is justifiable to use the time and resources needed to conduct a crisis management exercise to build separate exercises for Krivat, or if the information exchange and interoperability problems could be tackled by some other means.

The survey consisted of six questions in Finnish. The table below lists the translated questions and what information was sought with them. Appendix 1 has a list of the questions in the form they were sent to the recipients.

Number	Question	Aim of the question
1	Think of two to three crisis management exercises that have in your opinion been successful events. Briefly describe these exercises (scope, duration, aims, type etc.).	This question was meant to provide background information on what kind of exercise events the responders saw as successful.
2	Which elements in your opinion made these events successful?	The aim here was to identify if there were any prevailing elements that affected the success of an event or if these were subjective.
3	Please rate how much in your opinion the exercises developed or clarified the following: mutual trust, cooperation, information exchange and communication, clarity of the aims of preparedness work, task interdependencies, COP needs, organisation structure in a multi-organisation response, and joint responsibility.	These elements have been found to characterize interoperability, and the aim of this question was to see if the successful exercises from the previous questions could also develop these.
4	Think of two or three crisis management exercises that have in your opinion been unsuccessful events. Briefly describe these exercises (scope, duration, aims, type etc.).	This question was again meant to provide background information for the next questions.
5	Which elements in your opinion made these events unsuccessful?	The aim here was to identify the pitfalls as experienced by the participants.
6	Please rate how much in your opinion the exercises developed or clarified the following: mutual trust, cooperation, information exchange and communication, clarity of the aims of preparedness work, task interdependencies, COP needs, organisation structure in a multi-organisation response, and joint responsibility.	Question 6 was identical to question 3. The aim was to see if an exercise that the participants felt was unsuccessful could still be useful.

Table 3: Survey questions

The results from these questions are discussed in the next section.

4.2.2 Survey results

The survey was sent out to six individuals with varied, extensive backgrounds involving preparedness or crisis management exercises. Out of these, five responses were gained. The responses were all useful data and they answered the questions that were being asked. There were two points that arose from the responses that might have been clarified with a larger sample size.

The first question handled background information about the successful exercises referred to later on in the survey. All five responses referenced a different event. Many responses named a specific exercise by name. Two responses named specific TIETO-exercises as successful. A third response mentioned a joint exercise for information society actors, which might also be a reference to the TIETO-exercises, however this was unclear from the background information. One response referenced a smaller exercise conducted just within their own organisation.

The second question asked the respondents to name the factors they saw as important to the success of the events. Here one response seems to have been submitted incompletely as it breaks off in the middle of a sentence.

Three responses mention the exercise being wide in scope (*laaja-alainen*) or some equivalent as a factor. Three responses also mentioned realism or some synonym of it. The correct participants or some equivalent phrase was also mentioned by three participants.

Two responses mention good planning, organisation at location and good common communications systems as influences to the success of the events.

One response mentions the participant's own active participation in preparing for the exercise and during the event itself, implying that no matter how well an exercise is planned and carried out, if the participants themselves do not feel like actively participating they will very likely view the event as a waste of their time.

One response mentioned the exercise handling situations from outside of normal work, enabling preparation for situations not often encountered.

The table below lists all the factors mentioned.

Factor	Phrases used in responses
Width of exercise scope	Exercise included and noted all stakeholders in a real situation
	Different actors were well represented
	Wide representation from different groups
Realism	Realistic training situations
	Stakeholders during a real situation
	Discussion based on the resources and capabilities of stakeholders, not just imagining what those might be.
Good organisation	Good operating instructions during exercise
	Preparations starting a year before the event
	Good organisation at the exercise location
Correct participants	Having the right people at the same physical location
Active participation	Participant's own active participation in exercise
	Participant engagement to the exercise
Communication systems	Good common communications systems to exchange information during the exercise

Table 4: Factors that made exercises successful

In question three, respondents were asked to rate to what extent the exercises referenced developed or clarified the following elements: mutual trust, information exchange and communication, cooperation, clarity of aims, task interdependencies, COP needs, organisation structure in a multi-organisation response, and joint responsibility. The scale was a likert scale from 1 to 5 (1 = not at all, 2 = a little, 3 = do not know, 4 = moderately, 5 = significantly).

In summary, most respondents considered the exercises had clarified or developed at least moderately all but the organisation structure in multi-organisation response. This is somewhat surprising since many of the exercises named in the first question were multi-organisation cooperation exercises.

All respondents rated the exercises as having clarified or developed task interdependencies. One response had rated the effect here as significant (5), the other four as moderate (4). COP needs were developed or clarified moderately in two responses and significantly in two, with

the fifth opting for do not know (3). Joint responsibility was impacted moderately in the opinion of four respondents, with the fifth again opting for do no know. Cooperation was developed or clarified significantly in the opinion of four respondent, whereas fifth respondent saw cooperation being developed only a little (2).

The table below illustrates the responses in detail.

	1, not at all	2, a little	3, do not know	4, moderately	5, significantly
Mutual trust		1	1	2	1
Cooperation		1			4
Information exchange and communication		1	1	1	2
Clarity or aims		2		3	
Task interdependencies				4	1
COP needs			1	2	2
Organisation structure		2	1	1	1
Joint responsibility			1	4	

Table 5: Results for question 3

Question four was again to gather background information for the exercise experiences that were unsuccessful in the opinion of the participants. One respondent answered that they have not participated in any exercises that they would consider unsuccessful as such.

From the other four responses, interestingly enough, two “themes” emerged. This is where a larger sample size would probably have either further defined these two themes or would have provided more variation to the answers.

Two of the responses mention a VALHA-exercise as an unsuccessful event, and two others mention multi-organisation cooperation exercises between rescue officials and defence forces.

In question five, detailing the factors behind these exercises being less than successful, three responses mention communication systems. All three mention a different aspect involving the communication systems, with one mentioning the exercise using communication systems still

in their development phase being used in the exercise, one mentioned a total lack of a common communications system and one mentioned an insufficient communications system being used at the exercise.

Three responses mention a lack of realism or some equivalent as an issue. One mentions the tendency of exercises becoming more like lectures and, on the other hand, time constraints forcing actions to be taken out of order during the exercise. Another response mentioned activities becoming check point-type instead of connected activities based on the scenario and the “big picture”.

Factor	Phrases used in the responses
Problems with communications systems	Unfinished system or system in beta testing
	Insufficient communication mechanism
	No common communication system, communication on paper
Lack of realism	“Exercise” was more like a lecture
	Time constraints force actions out of order (simultaneously instead of consequently, as would happen in reality)
	No touch to the real world
Connection between scenario and activities during exercise	Background scenario so weak that participants could not orientate themselves to the exercise
	Scenario and the “big picture” did not transmit to the participants
	No real-time situation awareness

Table 6: Factors in unsuccessful exercises

Question six asked the respondents to again rate their experiences impact on the same factors as in question three. The scale was also the same, a likert scale from 1 to 5 (1 = not at all, 5 = significantly, 3 = do not know).

Even though the respondents considered the exercises unsuccessful, the exercises still had a moderate developing or clarifying effect on mutual trust, cooperation, COP needs and joint responsibility. However, there were also responses which considered there to be no effect at all (1) or only a small impact (2).

The table below illustrates the division of the responses.

	1, not at all	2, a little	3, do not know	4, moderately	5, significantly
Mutual trust		2		3	
Cooperation		2		3	
Information exchange and communication	1	2	1	1	
Clarity of aims	1	2		2	
Task interdependency		3	1		1
COP needs	1	1		2	1
Organisation structure	1	2	1	1	
Joint responsibility		2		3	

Table 7: Survey results for question 6

In summary, the survey revealed considerations which need to be addressed either in development of Krivat or when considering using Krivat as a tool during an exercise. These considerations will be discussed in more detail in the next chapter.

4.2.3 Preparedness exercise observations

The preparedness exercise observed was conducted in Santahamina on 5 November 2015 by the Construction pool and the Regional preparedness committee of Southern Finland. The exercise in question was a tabletop exercise, with a preliminary task sent out approximately a month before the event. The participants were specialist-level and mid-management employees from various private and public organisations. The exercise lasted a full day, with first half of the day used for short orientation speeches and the second half of the day used for group work.

According to the organisers, the division for the groups had been made so that there would be a mix of branch-specific and cross-field expertise in order to truly gain insights into issues such as interdependencies.

For the sake of comparison, the exercise was observed using the same scale that was used in the survey. All in all, from the point of view of the observer, the exercise was successful. The

preliminary task and the scenario were well prepared. The speakers for the first half of the day spoke of relevant topics to the exercise and were well prepared for their speech. The task for the group work was well structured and considered the problem from different points of views.

As a developer of mutual trust, the exercise was moderately successful. An important factor in building trust is to acquaint individuals from different organisations with one another. People trust those individuals they know and have judged trustworthy.

It is one thing to conduct an exercise where everyone speaks about cooperation and then to bring the talk into action. Many of the organisations present recognised that in a major disturbance many organisations may compete for the same limited resources and therefore cooperation is essential. Just talking about it during an exercise scenario may not be enough to bring about cooperation under a real disturbance situation, however it is a start. If it is being talked about, it is being thought about, and therefore the exercises would seem to be at least a moderate success in this aspect as well.

The exercise did not have much impact on information exchange and communications. There was no real time interaction between the groups during the group work phase and the scenario did not develop during the phase so that it would have required any interaction. The groups had all the information that they needed, or at least all the information that they thought they needed. If there would have been development in the scenario during the group work phase and the groups would have needed to consult one another, there might have been observations about this aspect.

In terms of the clarity of the goals of preparedness activities, they seemed to be somewhat clear to most participants in advance. The nature of these exercises is such that the same individuals participate in several such exercises and have in some cases been involved in the activities for several years. For a first time participant, the exercise clarified more what the activities and actors during a major disturbance are and not so much the higher level goals of the activities.

In terms of task interdependencies, this exercise focused in part specifically on them. During the group work one of the main concerns was the interdependencies during the specified scenario, and therefore this exercise developed the understanding of task interdependencies well.

Situation awareness and common operating picture (COP) were a common topic throughout the day. There were two things that stood out from the discussions related to SA and COP. One was that there is a weariness related to all talk about SA and COP, they are seen as the fashionable concepts that everyone thinks is necessary. The second thing was, that in order to be fruitful, discussion about SA and COP should be shifted from focusing on whether organisations need SA to what kind of SA they need. There was one statement which recognised this to a degree, calling for SA information that is somehow processed instead of raw data. Since the discussion was not really moved from the level of saying SA is necessary to the level where the more specific needs could have been addressed, the exercise cannot be said to have been very useful in terms of clarifying or developing SA and COP needs.

The exercise did not take into account at all the organisational structure of a multi-organisation disturbance response. The group work could have given thought to this issue, since it is a major obstacle in the way of functioning multi-organisation responses. The question of who takes initiative to assemble a multi-organisation response structure is important.

Joint responsibility was also not a concern of this exercise. The exercise participants focused more on the individual, specific responsibilities of the participating organisations. The issue of joint responsibility and the recognition of the issue is perhaps in the willingness of organisations to actively consider the issues discussed in the exercise and to participate in such events to pool expert resources to solve as many of the problems as possible before any significant disturbance happens, but there was no explicit recognition, clarification or development in joint responsibility.

4.3 Scientific validity

Action research as a research method has been criticized as less scientifically rigorous as for example the different quantitative methods. The method allows the researcher to take a very active role in the process and the idea of objectivity is all but abandoned. For this thesis the method, however, worked well since the process under study was and is constantly improving and forcing it into a halt for the duration of the study might have caused damage to the actual Krivat framework. It also allowed for less well working solutions and ideas to be discarded immediately instead of having to wait out the process.

For the survey, there are two main points of concern, namely the sample size and the question formation. For a more representative view on the patterns revealed by the survey, a larger sample size would have been necessary. Since the point of the study was not to generate statistically significant results, the small sample size was deemed sufficient. The participants were selected on the basis of their backgrounds and experiences regarding the issue under study to ensure a wider variety of results. (Relevant Insights, 2011)

The survey questions were reflective of the issue being studied, addressing the issue of content validity. Since the survey was done for benchmarking purposes, the internal validity of the survey was ensured by making certain the questions answered the correct issues. In terms of external validity, the small sample size prevents the results from being generalizable to a larger group. (Relevant Insights, 2011)

Reliability of the survey can be called good, since the answers from it were consistent. The type of information gained was the same type, despite the background and experience of the respondent. (Relevant Insights, 2011)

5 Conclusions

This thesis had a main goal to develop the collaboration process of Krivat by discussing the problems related to bringing various types of organisations. There were three research questions:

1. How to facilitate interoperability in Krivat?
2. How effective is a user introduction as a way to facilitate interoperability?
3. What kind of an exercise would be the most useful as a facilitator of interoperability?

In general, this thesis gives an idea of good ways to facilitate interoperability. Issues such as shared situation awareness and interoperability alone could by themselves be topics for a thesis, and therefore the theory introduced in this thesis is a scratch of the surface. It does, however, provide a starting point and has clarified the issues which, in turn, will make further study and familiarization easier.

It was difficult to assess the effectiveness of the user introduction event and, in hindsight, the question should have been phrased differently. As a process the action research did yield insight into the user introduction event and how to improve it through the reflection phase of the process.

The question for the benchmarking was answered better by the research than the question for the action research. The answers gave a good idea of exercising in general as a useful facilitator of interoperability, and in addition gave examples of exercises that had, in the opinion of the respondents, clarified or developed several of the interoperability characteristics specified by Pollock and Coles (2015).

One of the main conclusions drawn from all the work involved in the thesis is that as Krivat stands now, trying to build an exercise or even a template for a series of exercises may not be the best use for the resources of the Krivat administration. The organisations involved in Krivat are already actively involved in many exercise organisations, and therefore adding another time- and resource consuming exercise would not add anything significantly different to warrant the drain on resources. More efficient than trying to come up with own exercises for the Krivat framework would be to actively include the use of Krivat into the existing exercises administered by the regional preparedness organisation, for example.

Smaller exercises are useful as activators in user training events and to keep users active. One of the dangers for the framework at the moment is the disuse, that is, the large amounts of time the systems remains unused between disturbances. Smaller, even organisation specific exercises would help users to remember Krivat as a viable option, otherwise the response during a live crisis may be to fall back on same old routines. As was pointed out by one survey response, time constraints forced activities to happen out of order (simultaneously instead of consecutively as would be the real sequence of events) which diminishes the value of the exercise. A full scale exercise either using Krivat or within the Krivat operating environment would be very likely to stumble upon this same problem, due to the nature of major disturbances and responses to them usually lasting days.

In terms of exercising helping to establish interoperability, the benchmarking done for this thesis suggests that it is useful. To ensure this, interoperability characteristics should be considered in the planning and preparation of the exercise. Even those exercises which the surveyed found were unsuccessful, developed or clarified many of the interoperability characteristics at least moderately.

All those surveyed thought that their successful exercise experiences either developed or clarified task interdependencies. Most also saw developments or more clarity in cooperation, communication and information exchange, COP needs, and joint responsibility. A larger sample size likely would have given either more variation in the responses or it would have strengthened the results gained from the small sample, provided there would have been more actual responses.

The small sample size for the survey was justifiable for two reasons. For one, the actual answers held valuable information in the open questions. The benchmarking was not the primary research effort for this thesis and therefore the amount of responses was sufficient, since care was taken to ensure the responders had varied backgrounds and extensive experience with participating in crisis management or preparedness exercises. Even if the actual sample size would have been larger, for example 15, but without a significant increase in the amount of responses, the end result would not have changed.

The literature review for this thesis revealed several development objects that should be handled before any exercises specifically using Krivat are to take place. One such item were rules describing the communication responsibilities during a disturbance. This need came from the closer study of interoperability and the problematic issue of communication responsibilities in general.

Another development point that arose from the research was the point of processed information to help situation awareness. Krivat is not a system for creating common operating picture, though it has elements of it. It is a system for SSA, and SSA requires more than just the bare necessities that could be found anywhere. There needs to be some added value to the information. What information to analyse and assess, how, and by whom? There is a huge pitfall in trying to interpret data for someone else, it stands to reason to ask if it should even be attempted in Krivat.

Since information overload is a real issue, more data does not equal more information. This is a major topic to consider in the future development of the framework. It must be taken into account when adding new information providers to the community and in considering the services of existing information providers.

In general, as an activator of the Krivat users, the user introduction on its own is not the most efficient way. The user introduction is still too much of a lecture, and needs either an atmosphere open to discussions or a more engaging small-scale exercise to activate the participants. This point became apparent during a series of introduction events after the action research had already been conducted.

The introduction was carried out at three new framework member organisations, using the introduction template with a short discussion exercise at the end. The biggest difference between these three events and the three events described in the action research was not in the introduction but in the person doing the talking. For these three events, there was in addition to myself two other colleagues present, who handled a significant portion of the talking. Due to their backgrounds in similar organisations and familiarity with the field, they were

able to generate an atmosphere where the users became enthusiastic about the framework and the discussion exercise became moot. This more than the actual action research suggests that the introduction can be an important tool in activating Krivat users to consider the framework and what the users could do with it.

The introduction event is a necessary part of the process of organisations starting their Krivat use. Users must be shown what the system is capable of and how to use it. It is also apparent that small, engaging exercises must be conducted in order to keep Krivat in the minds of the users. Major disturbances such as the Valio storm are predictable and fairly common, however unless they become a monthly occurrence, they will not be so common as to activate Krivat users.

References

- Anttila, P. 2007. Toimintatutkimus. Accessed 26 August 2015.
<http://www2.amk.fi/digma.fi/www.amk.fi/opintojaksot/0709019/1193463890749/1193464158778/1194360111832/1194360447229.html>
- Australian Emergency Management Institute. 2012. Managing Exercises. Accessed 14 October 2015.
<https://www.ag.gov.au/EmergencyManagement/Tools-and-resources/Publications/Documents/Handbook-series/handbook-3-managing-exercises.pdf>
- Berlin, J. M. & Carlström, E. D. 2015. Collaboration Exercises: What Do They Contribute? - A Study of Learning and Usefulness. *Journal of Contingencies and Crisis Management*. Volume 23 Number 1. 11-23.
- Boin, A. & McConnell, A. 2007. Preparing for Critical Infrastructure Breakdowns: The Limits of Crisis Management and the Need for Resilience. *Journal of Contingencies and Crisis Management*. Volume 15 Number 1. 50-59.
- Business Dictionary. 2015. Crisis management. Accessed 3 August 2015.
<http://www.businessdictionary.com/definition/crisis-management.html>
- Cabinet Office. 2013. How prepared are you? Business Continuity Management Toolkit. Accessed 13 October 2015.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/137994/Business_Continuity_Management_Toolkit.pdf
- Finland. 2011. Competition Act 948/2011. Accessed 3 November 2015.
<https://www.finlex.fi/fi/laki/ajantasa/2011/20110948>
- Devitt, K. R. & Borodzicz, E. P. 2008. Interwoven Leadership: the Missing Link in Multi-Agency Major Incident Response. *Journal of Contingencies and Crisis Management*. Volume 16 Number 4. 208-216.
- Endsley, M. R. 2015. Situation Awareness Misconceptions and Misunderstandings. *Journal of Cognitive Engineering and Decision Making*. Volume 9, Number 1. 4-32.
- Fischbacher-Smith, D. & Fischbacher-Smith, M. 2014. What Lies Beneath? The Role of Informal and Hidden Networks in the Management of Crises. *Financial Accountability & Management*. 30(3). 259-278.
- Hagelstam, A. 2005. CIP - kriittisen infrastruktuurin turvaaminen - Käsiteanalyysi ja kansainvälinen vertailu. Huoltovarmuuskeskus. Julkaisu 1/2005.
- Harrald, J. 2006. Agility and Discipline: Critical Success Factors for Disaster Response. *The Annals of the American Academy of Political and Social Science*. Vol 604, no 1. 256-272.
- Harrald, J. & Jefferson, T. 2007. Shared Situational Awareness in Emergency Management Mitigation and Response. *Proceedings of the 40th Hawaii International Conference on System Sciences*.
- Hotchkiss, S. 2010. *Business Continuity Management: a practical guide*. Swindon: British Informatics Society Limited. Book from ebrary. Accessed 12 November 2015.
<http://www.laurea.ebib.com/patron/FullRecord.aspx?p=634527>
- Ibrahim, N. H. & Allen, D. 2012. Information Sharing and Trust During Major Incidents: Findings From the Oil Industry. *Journal of the American Society for Information Science and Technology*, 63(10). 1916-1928.

Ingemarsfotter, J. & Trané, C. 2013. Varför öva tillsammans? - mot en gemensam inriktning och samordning av tvärsektoriella övningar.

Juholin, E. 2006. *Communicare! Viestintä strategiasta käytäntöön*. Porvoo: WS Bookwell.

King, S. 2013. *Guidelines for Referencing*. Accessed 3 November 2015.

Kyrölä, T. 2010. *Liiketoiminnan strateginen johtaminen: strategiset päätökset jatkuvuudenhallinnan johtamiseksi*. Licentiate. Aalto University School of Economics.

MacFarlane, R. & Leigh, M. 2014. *Information Management and Shared Situational Awareness: Ideas, Tools and Good Practice in Multi-Agency Crisis and Emergency Management*. Accessed 24 August 2015.

<http://www.epcresilience.com/EPC/media/Images/Knowledge%20Centre/Occasionals/Occ12-Paper.pdf>

Merimaa, J. 2008. *Wiio ja Wiion lait*. Accessed 22 September 2015.

<http://www.helsinki.fi/ajankohtaista/uutisarkisto/2-2008/6-14-41-13>

NESA a. 2013. *Objectives*. Accessed 3 August 2015.

<http://www.nesa.fi/security-of-supply/objectives/>

NESA b. 2013. *Julkisen ja yksityisen sektorin kumppanuus*. Accessed 13 October 2015.

<http://www.huoltovarmuus.fi/tietoa-huoltovarmuudesta/julkinen-yksityinen-kumppanuus/>

Palm, J. & Ramsell, E. 2007. *Developing Local emergency Management by Co-Ordination Between Municipalities in Policy Networks: Experiences from Sweden*. *Journal of Contingencies and Crisis Management*. Volume 15 Number 4. 173-182.

Pearson, C. M. & Clair, J. A. 1998. *Reframing Crisis Management*. *Academy of Management Review*. 23(1). 59-76.

Pollock, K. & Coles, E. 2015. *Interoperability - Theory & Practice in UK Emergency Management*. Accessed 24 August 2015.

<http://www.epcresilience.com/EPC/media/Images/Knowledge%20Centre/Occasionals/Occ13-Paper.pdf>

PPP Knowledge Lab. 2015. *What is a PPP*. Accessed 13 October 2015.

<https://pppknowledgelab.org/ppp-cycle/what-ppp>

Relevant Insights. 2011. *Validity and Reliability in Surveys*. Accessed 18 October 2015.

<http://www.relevantinsights.com/validity-and-reliability#sthash.YFlIHkQP.dpbs>

Rummukainen, L., Oksama, L., Timonen, J. & Vankka, J. 2015. *Situation Awareness Requirements for a Critical Infrastructure Monitoring Operator*. 2015 IEEE International Symposium on Technologies for Homeland Security. 1-6.

Safety Investigation Authority. 2010. *Heinä-elokuun 2010 rajuilmat*. S2/2010Y.

Seppänen, H. 2015. *Defining critical information requirements and quality in cooperative disasters management*. PhD. Aalto University School of Engineering.

Stranden, J., Krohns-Välimäki, H., Verho, P., Sarsama, J. & Hälvä, V. 2014. *Influence of Major disturbances in Electric Supply on the Operating Environment of Distribution System Operators: a Case Study*. *International Review of Electrical Engineering*. Vol. 9, N. 2. 363-372.

Stroud, J. D. 2015. *Understanding the Use and Purpose of Benchmarking*. Accessed 2 September 2015.

<http://www.isixsigma.com/methodology/benchmarking/understanding-purpose-and-use-benchmarking/>

Figures

Figure 1: Positioning of Krivat	9
Figure 2: The BCM lifecycle (Hotchkiss 2010, 7)	16

Tables

Table 1: Observations from first cycle intervention at Organisation A	24
Table 2: Observations from the second-cycle intervention at Organisation A.....	26
Table 3: Survey questions	28
Table 4: Factors that made exercises successful.....	30
Table 5: Results for question 3	31
Table 6: Factors in unsuccessful exercises	32
Table 7: Survey results for question 6	33

Appendices

Appendix 1: Original survey questions 46

Appendix 1: Original survey questions

1. Palauta mieleesi 2-3 varautumisharjoitusta jotka ovat mielestäsi olleet onnistuneita tilaisuuksia. Kuvaile harjoituksia lyhyesti (laajuus, kesto, harjoituksen tyyppi, tavoitteet jne.).
2. Mitkä asiat tekivät mielestäsi näistä tilaisuuksista onnistuneita?
3. Missä määrin harjoitukset kehittivät tai selkeyttivät seuraavia asioita: keskinäinen luottamus, yhteistyö, tiedonvaihto ja kommunikaatio, varautumistoiminnan tavoitteiden selkeys, tehtävien keskinäiset riippuvuudet, tilannekuvat tarpeet, organisaatorakenne moniorganisaatiiovasteessa, yhteisvastuullisuus (asteikko 1-5, 1 = ei lainkaan, 5 = paljon, 3 = en osaa sanoa)
4. Palauta mieleesi 2-3 varautumisharjoitusta jotka ovat mielestäsi olleet epäonnistuneita tilaisuuksia. Kuvaile tilaisuuksia lyhyesti (laajuus, kesto, harjoituksen tyyppi, tavoitteet yms.)
5. Mitkä asiat tekivät mielestäsi näistä tilaisuuksista epäonnistuneita?
6. Missä määrin harjoitukset kehittivät tai selkeyttivät seuraavia asioita: keskinäinen luottamus, yhteistyö, tiedonvaihto ja kommunikaatio, varautumistoiminnan tavoitteiden selkeys, tehtävien keskinäiset riippuvuudet, tilannekuvat tarpeet, organisaatorakenne moniorganisaatiiovasteessa, yhteisvastuullisuus (asteikko 1-5, 1 = ei lainkaan, 5 = paljon, 3 = en osaa sanoa)