Examining Critical Dependencies

A Study of Swedish Municipalities' Risk and Vulnerability Analyses

Aline Regnell | Division of Risk Management & Societal Safety | LTH | LUND UNIVERSITY, SWEDEN

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Abstract
To the ensure continuity and protection of critical infrastructures in society, it is necessary to study infrastructure dependencies. This thesis focuses on critical infrastructure dependencies in Sweden and aims to increase the knowledge of how municipalities in Sweden analyze critical dependencies in municipal risk and vulnerability analyses (RVAs). The study adopts a framework of risk governance, risk management, and infrastructure interdependencies to explore four research questions: What actors are municipalities cooperating with in the identification of critical dependencies? How is the institutional context affecting municipalities' work with critical dependencies? What pre-defined methods are municipalities working with and what types of critical dependencies are identified? In what ways are the municipalities using the analysis of critical dependencies? The study is based on a qualitative approach using a document review of municipal RVAs together with interviews with representatives from 16 different municipalities. The study shows that municipalities face similar challenges in analyzing critical dependencies due to the complexity of critical dependencies and lack of clear delimitations to the analysis. Access to resources and a lack of institutional memory also hinder the work. The study suggests that there are local variations in the use of standardized methods in the analysis of critical dependencies and that municipalities ask for more targeted support in the analysis. Currently, confidentiality issues surrounding data are hindering such support and collaboration in the analysis. The study concludes that municipal work with critical dependencies varies across the country, with some municipalities having more profound work with critical dependencies than others.

Acknowledgments

Summary

Critical dependencies are understood as a connection between two infrastructures in which the functionality of one infrastructure affects the functionality of the other infrastructure. Understanding the critical dependencies that society is facing is important to build preparedness and minimize damage to both infrastructures and society. This thesis explores how municipalities in Sweden work with identifying and managing critical dependencies.

According to Swedish crisis management regulations, municipalities are most often the responsible actor to handle a crisis when it emerges. Every fourth year, municipalities produce risk and vulnerability analyses (RVAs) to assess risks and critical dependencies within the municipality to reinforce crisis preparedness. Drawing from previous studies, there is a suggested lack of understanding of how municipalities are working with critical dependencies within the RVA process. This thesis uses a conceptual framework based on risk governance and risk management, along with key concepts of critical infrastructure (CI), CI interdependencies, and vital societal functions (VSFs) to explore four research questions. To be able to explore the research questions, the thesis takes on a qualitative case study approach and examines RVAs from twelve different municipalities, complemented by 16 interviews performed with preparedness coordinators, security coordinators, and heads of security from a total of 16 municipalities in Sweden. The documents and interviews were analyzed through a thematic inductive analysis.

The study suggests that while most municipalities follow standardized national methods and guidelines in the identification and analysis of critical dependencies, there are local variations in their use. What method is used within municipalities is depending on available resources and knowledge in terms of staff background, and the level of cooperation with other municipalities. Several municipalities face similar challenges in deciding delimitations of the analysis of critical dependencies within the RVA process, but also in monitoring results from the RVAs and in applying identified measures for continuity. These challenges seemingly arise due to a lack of capacity or staff turnover, but it is also connected to a lack of detailed guidelines for the analysis. Generally, municipalities wish for more targeted support for the analysis of critical dependencies and broader actor engagement in the assessment and follow-up of critical dependencies.

Currently, some issues are hindering support and collaboration in the analysis of critical dependencies and there is a need to find methods that promote collaboration between municipalities and actors on different levels. The methods must also be able to support municipal processes with RVAs while avoiding the security and confidentiality issues currently hindering the engagement of different actors. Moreover, an analysis of critical dependencies on a system-level approach beyond local impacts is currently hindered. This is due to factors such as the complexity and confidentiality surrounding critical infrastructure, but also because of the use of different methodologies for analysis, monitoring, and follow-up, and the fact that municipalities only are responsible for risks within their geographical area. Critical infrastructures and vital societal functions are often connected through networks, either physical or connected through information technologies, that span across municipal boundaries. However, the perceived value within municipalities of conducting an analysis and having the

knowledge of critical dependencies is generally high. The study concludes that municipal work with critical dependencies varies across the country, with some municipalities having more profound work with critical dependencies than others.

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List of Abbreviations

CI   Critical Infrastructure

FEH   Regulation (2006:637) on measures by municipalities and regions before and during extraordinary events in peacetime and heightened preparedness

LEH   Act (2006:544) on measures taken by municipalities and county councils before and during extraordinary events in peacetime and heightened preparedness

MSB   The Swedish Civil Contingencies Agency

RVA   Risk and Vulnerability Analysis

SKR   Swedish Association of Local Authorities and Regions

VSF   Vital Societal Function

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1. Introduction

Modern societies are built on the ability to move goods, people, and information safely and reliably (Rinaldi et al., 2001, pp. 11-12). Thus, it is important for all components of the society – from businesses to citizens and governing bodies – that a nation's infrastructure and vital societal functions can operate without disruptions. Infrastructure is a broad concept and entails structures of roads, railroads, energy supplies, or structures alike, built to ensure daily life in society (ibid.). However, in this study, the notion of *critical* infrastructure (CI) is of interest. In Sweden, the term CI is heavily intertwined with what is called vital societal functions (VSFs) which include functions, services, or CIs that are necessary for the provision of basic needs of society (MSB, 2021a, p. 3). CIs and VSFs provide society with for example water, and electricity, and sustain economic development (Wang et al., 2020, p. 1).

Many infrastructures, and thus vital societal functions, are dependent on or interdependent with other infrastructures, meaning that CIs do not operate in silos (Wang et al., 2020, p. 277). For example, a water treatment plant may be dependent on electricity produced in another infrastructure to be able to function (Maktabifard et al., 2018), and emergency vehicles require fuel and accessible roads (Rinaldi et al., 2001). Today, infrastructures are facing a variety of threats, and risk becoming disrupted by a broad range of both natural and man-made hazards (Little, 2002, pp. 109-110; Svegrup et al., 2019). Disturbances in infrastructure can have small-scale effects, but they can also cause enormous damage to the values of modern society such as human life and health through cascading effects that spread through a system of infrastructures (Kotzanikolaou et al., 2013, p. 171; Little, 2002; MSB, 2017). Failing to understand and study how infrastructure disruptions can be affected by and spread through dependencies and interdependencies, risks causing a lack of preparation if such a disruption would happen (Lewis & Petit, 2019, p. 3).

This qualitative research focuses on critical infrastructure dependencies in Sweden, called *critical dependencies*. In 2017, the Swedish government presented the national strategy for security intending to protect the life and health of the population and it is highlighted that the population's safety is considered to be closely linked to vital societal functions (Regeringskansliet, 2017, p. 6). In Sweden, ownership, and responsibilities for CIs' functionality are divided between public and private operators at local, regional, or national scales, such as municipalities, county councils and administrative boards, or national authorities (MSB, 2014, pp. 17-19). Sweden has 290 municipalities which all are responsible for the provision of some vital societal functions such as health care, and the provision of drinking water (MSB, n.d.-a). Municipalities are most often the responsible actors in a crisis due to Sweden's crisis management structure that starts from the local level (Cedergren et al., 2019, p. 783; krishantering.se, 2022). Thus, it is of the highest importance that municipalities are aware of their vulnerabilities and strengths to be able to handle different disastrous scenarios.

Every fourth year all municipalities are required to conduct a risk and vulnerability analysis (RVA) overseeing municipal risks and vulnerabilities, including critical dependencies (MSBFS 2015:5). A few studies have already been conducted on how municipalities work with RVAs (see e.g. Cedergren et al., 2019; Eriksson, 2016; MSB, 2011) and current research seems to

focus on for example the development of new guidelines for RVAs (Hedtjärn Swaling & Ödlund, 2021). However, most previous studies have generally focused on the overarching RVA process and up-to-date studies on municipal processes managing critical dependencies seem to be lacking in the knowledge field. Seeing the argued importance of understanding critical dependencies, this study sets out to see how municipalities are working with that today.

1.1 Research Aim and Questions

The aim of this thesis is to explore how Swedish municipalities are working with critical dependencies. Due to the obligation of Swedish municipalities to conduct RVAs and to identify dependencies and interdependencies, this research focuses on analyzing how municipalities are working with the concept of critical dependencies within the RVA process. The study will be guided by a conceptual framework of risk governance and risk management, presented in Chapter 2, and the overarching aim of the thesis has accordingly been divided into four areas with associated questions which are presented in the table below.

Table 1 – Research questions

Area	Research Question
Actors	RQ 1: What actors are the studied municipalities cooperating with in the identification of critical dependencies?
Institutional Context	RQ 2: In what ways is the institutional context affecting the studied municipalities' work with critical dependencies?
Identification	RQ 3: What pre-defined methods are the studied municipalities working with and what types of critical dependencies are identified?
Information Management	RQ 4: In what ways are the studied municipalities using the analysis of critical dependencies?

1.2 Delimitations

As seen in the introduction, studying critical dependencies is a complex matter which spans across actors and levels of society. However, this thesis only studies municipalities and their work with critical dependencies within the process of creating municipal RVAs. Municipalities may also work with critical dependencies in a separate process of contingency management (Eriksson, 2016, p. 10; MSB, 2022b). However, to study several processes would not be possible due to the time limit of a master's thesis.

1.3 Thesis Structure

This thesis consists of seven chapters. Chapter 2 will present the conceptual framework and key concepts on which this study builds. After that, Chapter 3 presents a short introduction to the Swedish context in which this study is set, followed by Chapter 4 which describes the methodology and methods of analysis of this thesis. Thereafter follows a presentation of the main results of this study in Chapter 5, which are discussed in Chapter 6. Chapter 6 also includes a short discussion on the limitations of this study, together with a suggestion for further studies. Lastly, Chapter 7 presents the conclusions of this thesis.

2. Conceptual Framework

In this chapter, the conceptual framework of risk governance and risk management on which this paper builds its explorative approach is introduced together with the concepts of critical infrastructure, vital societal functions, and infrastructure interdependencies.

2.1. Risk Governance and Risk Management

In this thesis, a framework of risk governance and risk management will be used as a guiding theoretical concept to be able to explore how municipalities in Sweden work with critical dependencies in the RVA process.

The framework of risk governance is often explained as framing risk and decision-making related to risk in a setting of governance principles and structures (Aven & Renn, 2010). This means that risk governance considers a multitude of factors that can both affect but also constitute such structures and principles in relation to risk management. Thus, the concept acknowledges actors, processes, rules, and practices involved in the collection, analysis, and communication of risk (ibid.). For example, risk governance encompasses actors involved in a governance process, from governmental to private actors. This allows the concept to be used in situations where no actor has single responsibility for a task. Therefore, the concept is helpful when the need for collaboration and coordination between different stakeholders is present (ibid.). Additionally, it is arguably useful in studying complex issues within the public sector (van Asselt & Renn, 2011). This thesis is limited to studying how one actor, municipalities, is managing the complex matter of infrastructure dependencies. But as seen in the introductory chapter of this paper, the complexity of infrastructure dependencies arguably encapsulates the need for coordination between actors.

Furthermore, risk governance considers contextual factors (ibid). Such contextual factors can differ in what Aven & Renn (2010) calls "institutional arrangements" and entails legal frameworks and regulatory structures influencing relationships between actors. It also has a great focus on how roles and responsibilities are divided – partly to be able to examine both mechanisms of coordination and incentives. The institutional arrangements can also apprehend the surrounding political culture (ibid.). For example, risk governance captures two types of relationships between involved actors, either horizontal relations on the same administrative and functional levels or vertical relations which consider interactions in-between levels.

Risk is always complex (ibid., p. 56). Management of systemic risks may need a holistic perspective of identifying hazards and assessing different risks, but acceptability and risk management judgments may also be necessary (ibid.). Moreover, due to the inherent complexity of risks, risk management addresses relationships between actors, but it also advocates coordination and overcoming silo-working through cross-sectoral integration of actors (Strömgren, 1997). Having a holistic approach means going beyond consequence analyses and towards spill-over effects and interdependencies (ibid.). Anyhow, to make it easier to study complex matters such as risks, risks are often reduced to a level of comprehensibility and seen as something that can be managed within an organizational entity (Becker, 2014). Though, this may result in a loss of the holistic perspective needed since the process of

simplifying the studying of risk may also create a sense of demarcation of the risk itself (van Asselt & Renn, 2011).

2.2 Critical Infrastructure

As in many areas, central definitions of concepts evolve and may coexist across time and disciplines. In this thesis, a definition of CI from the European Commission is used:

> Critical infrastructure is an asset or system which is essential for the maintenance of vital societal functions. The damage to a critical infrastructure, its destruction or disruption by natural disasters, terrorism, criminal activity or malicious behavior, may have a significant negative impact for the security of the EU and the well-being of its citizens. (European Commission, n.d.)

However, the EU does not define specific assets nor recognizes interdependencies. Arguably, what is of interest in this definition is the mention of VSFs and this will be further explained and explored below.

2.3 Vital Societal Functions

As mentioned already in the introduction, a VSF is a function, service, or CI which is necessary to maintain the basic needs of society, but also for values and security issues (MSB, 2021a, p. 3). In Sweden, there are 14 predefined societal sectors in which VSFs are found (MSB, 2014, p. 13; MSB, 2021a, pp, 4-10). These sectors are presented in the table below.

Table 2 – List of societal sectors in which VSFs are found in Sweden

Vital Societal Function Sectors in Sweden	
- Childcare and education	- Drinking water, sewage, and waste treatment
- Financial security	- Energy supply
- Financial services	- Trade and industry
- Health, healthcare, and social care	- Information and communication
- Food supply	- Public administration
- Law and order	- Staffing
- Rescue service and protection of civilians	- Transportation

2.4 Infrastructure Interdependencies and Critical Dependencies

Dependencies and interdependencies between infrastructures normally help optimize infrastructure systems and make them work more effectively (Serre & Heinzlef, 2018, p. 236). However, the dependencies and interdependencies may become problematic if a disruption occurs. Damage, or any other type of interruption, risks creating effects spreading throughout networks of dependent and interdependent infrastructures.

Infrastructure dependencies and interdependencies can be defined differently. Rinaldi et al. (2001, p. 14) define infrastructure dependency as "a linkage or connection between two infrastructures, through which the state of one infrastructure influences or is correlated to the state of the other". Dependencies are considered one-way relations, with infrastructure being dependent on inputs from another infrastructure in order to maintain its functionality. If a disruption in one end of a dependency would interrupt and impair the activity and functionality in the dependent infrastructure, the dependency is considered critical (Serre & Heinzlef, 2018, p. 236). However, the term interdependencies recognizes that dependencies may be bi-directional, meaning that infrastructures are dependent on each other's inputs and outputs rather than simply flowing in one direction.

Infrastructure dependencies and interdependencies transcend, by definition, sectors, companies, and geographical boundaries (Gillette et al., n.d.). Such dependencies and interdependencies can also be of varying complexity and scale. They can span from local, regional, national, or even international levels with linkages and transport systems of resources or telecommunications. The different levels and scales create difficulties in studying the phenomena since it adds further complexity of arising temporal and spatial issues (ibid.). Therefore, mapping dependencies or interdependencies in-between infrastructures connected in a network of dependencies/interdependencies is arguably surrounded by challenges. However, it has been disputed whether "interdependencies" do exist, or if dependencies are more common in real-life infrastructure operations (Silvast et al., 2021, p. 81). Studies on the topic recognize infrastructure dependencies on electricity, as an example. However, the power infrastructure may not be much dependent on inputs from other sectors (ibid.). This would mean that interdependencies can be apparent, but in many cases, it would also be possible to simply see a network of one-way dependencies. Nevertheless, the limitations of studying critical infrastructure and dependencies/interdependencies are often limited due to confidential information (Rinaldi et al., 2001, p. 24).

To exemplify this, infrastructure dependencies and interdependencies can be described with a theoretical framework put forward by Rinaldi et al. (2001). According to this framework there are four types of dependencies, as seen in Table 4 below (ibid., pp.14-16). Thus, depending on what type of dependency or interdependency a CI or VSF is a part of, different types of disruptions can have different effects.

Table 3 – Types of critical infrastructure dependencies

Type of Dependency	Description
Geographic	If two or more systems of infrastructure are affected by one local event and therefore are co-located within an area.
Physical	If infrastructure is dependent on material outputs of another infrastructure.
Cyber	If infrastructure is dependent on information from another infrastructure, and if that information is transmitted through information technologies.
Logical	If infrastructure is dependent on another infrastructure in another way than through geographic-, physical-, or cyber connections.

In Sweden, infrastructure dependencies are called "kritiska beroenden" and are defined as the following: "*Dependencies that are crucial for the functioning of vital societal functions. Such dependencies are characterized by the fact that a failure or disruption in supplying operations relatively immediately leads to functional impairments, which can result in an extraordinary event occurring*"[1] (MSBFS 2015:5, author's translation). Translating the term "kritiska beroenden" from Swedish to English is not uncomplicated, seeing there is a debate regarding the two terms "dependencies" and "interdependencies" (Rinaldi et al., 2001, p. 14). In Sweden, the term "dependency" seems to be the more used (see e.g. MSB, 2009) which focuses on either the delivering and the receiving facilities within an infrastructure dependency. The word "kritisk" refers to the fact that the specific dependency mentioned is critical for the operations of the infrastructure and that the infrastructure would not be able to function for an extended period without the specific dependency (ibid., p. 25). Thus, this concept does not refer to any of the specific dependencies mentioned in Rinaldi's theory explained above, but rather focuses more on the perceived level of importance for the infrastructure's normal functions (ibid.). In this paper, in line with the above reasoning, the concept "kritiska beroenden" will be translated into "critical dependencies".

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[1] The original quote in Swedish is: "*Beroenden som är avgörande för att samhällsviktiga verksamheter ska kunna fungera. Sådana beroenden karaktäriseras av att ett bortfall eller en störning i levererande verksamheter relativt omgående leder till funktionsnedsättningar, som kan få till följd att en extraordinär händelse inträffar*" (MSBFS 2015:5).

3. Swedish Municipalities and RVAs

This chapter will give a brief introduction to the political nature of Swedish municipalities and present a background to the municipal RVA.

Municipalities in Sweden are working under what is called municipal autonomy, which gives the municipalities the right to make independent decisions (Sveriges kommuner och regioner, n.d.). The municipalities are politically driven, with politicians elected to a municipal council[2] every fourth year. The council is the highest decision-making body in a municipality and is responsible for selecting the municipal board[3] and delegates for the municipal committees[4]. The committees are responsible for different areas of the municipality's mandatory tasks and there are often a number of committees within a municipality. Furthermore, within these committees there are civil servants working with the municipal administrations[5]. The civil servants at the municipal are responsible for realizing the decisions made by the committees (ibid).

Moreover, Swedish municipalities are responsible for certain activities[6] as part of the municipal mission from the state and to the citizens (Sveriges kommuner och regioner, 2021). The civil servants at the municipal administration are the ones who in practice administer and manage the implementation of municipal activities, even though the committees have the ultimate responsibility (Sveriges kommuner och regioner, n.d.) The mandatory tasks encompass the following (Sveriges kommuner och regioner, 2021):

Table 4 – List of mandatory municipal activities

Mandatory Municipal Activities	
- Social care (elderly and disabled care as well as individual and family care)	- Pre-school, primary and secondary school, and municipal adult education
- Plan and construction issues	- Environmental and health protection
- Cleaning and waste management	- Water and sewer
- Rescue service	- Crisis preparedness and civil defense
- Library operations	- Residences

As seen, some of these tasks overlap with the list of societal sectors connected to VSFs. While the activities in Table 3 are mandatory, activities surrounding leisure and culture, energy, employment, and business development are optional municipal activities (ibid.).

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[2] The original term in Swedish is "kommunfullmäktige".
[3] The original term in Swedish is "kommunstyrelse".
[4] The original term in Swedish is "nämnder".
[5] The original term in Swedish is "kommunala förvaltningar".
[6] The translation "municipal activities" is used in this thesis since this term is prevalent in the study *Understanding practical challenges to risk and vulnerability assessments: the case of Swedish municipalities* (Cedergren et al., 2019), mentioned in the introduction of this study. The original term in Swedish is "kommunala verksamheter".

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                    Municipal
                    Council
          ┌────────────┼────────────┐
     Municipal     Municipal     Municipal
     Committees      Board       Companies
          │
     Municipal
    Administrations
          │
          └── Municipal
              Activities
```
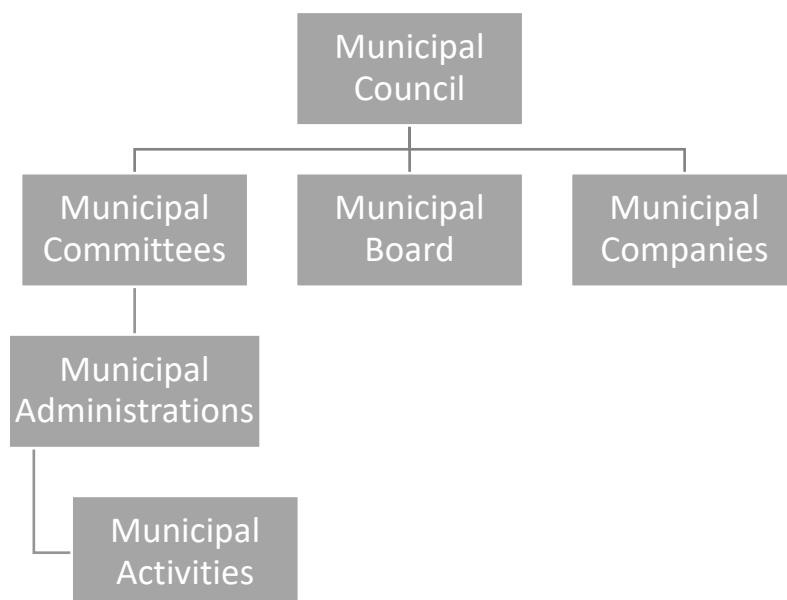
Figure 1 – A simplified chart of how a municipality in Sweden can be organized. Author's own depiction.

As a part of the municipal commitments, it is also a responsibility to conduct RVAs. In Sweden, RVAs are conducted on a national, regional, and local level. That means such analyses are carried out by government authorities, county administrative boards, regions, and municipalities (MSB, 2021b). The analyses that state authorities, regions, and municipalities are required to conduct are described as a first step to reducing risks and vulnerabilities, but also to improving capabilities to prevent, withstand and deal with crises and risks (ibid.). All these actors have different roles and responsibilities, and therefore their RVA can look very different (Lusua et al., 2011, p, 36). However, municipal RVAs are not only used for understanding risk within the municipal area, but they can also be used to aggregate information and understand risk from regional and national perspectives as well (Cedergren et al., 2019, p. 783).

For Swedish municipalities, RVAs have been a part of municipal official documents since 2006, when a legal requirement for municipalities to work with RVAs was implemented (SFS 2006:637). Today, a few major governing documents and regulations affect the work with critical dependencies in municipalities, such as the "*Act on measures taken by municipalities and county councils before and during extraordinary events in peacetime and heightened preparedness*"[7], "*Regulation on measures by municipalities and regions before and during extraordinary events in peacetime and heightened preparedness*"[8], and an agreement between the Swedish Association of Local Authorities and Regions (SKR) and MSB[9] (MSB & SKL, 2018). The RVAs are created at the beginning of every new term of office and all municipalities are required to update the RVA once every fourth year, in line with the general election periods (MSB, 2021c). This also means that all municipalities should have equally updated documents and analyses. For the general RVA process, there are a few different methods and guidelines

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[7] Lag (2006:544) om kommuners och landstings åtgärder inför och vid extraordinära händelser i fredstid och höjd beredskap (LEH).

[8] Förordning (2006:637) om kommuners och regioners åtgärder inför och vid extraordinära händelser i fredstid och höjd beredskap (FEH).

[9] Överenskommelse om kommunernas krisberedskap 2019-2022.

on which the municipality can build their analyses, but there is no standardized method for all municipalities (Hedtjärn Swaling & Ödlund, 2021). The RVAs should be reviewed once every year and this revision should be sent to the county administrative boards (SFS 2006:637).

The municipal RVA contains investigations of "extraordinary" events that could happen during peacetime, and identification of vital societal services and dependencies, but it should also present what measures may need to be taken to work with the identified vulnerabilities (ibid.). For critical dependencies, the municipal analysis can help the municipality and its activities to map the surrounding risks, vulnerabilities, and capabilities (MSB, 2009, p. 18). This analysis can also be used in an aggregated analysis of dependencies on a national level and facilitates the prioritization of necessary measures for the division of resources (ibid.). The work with critical dependencies should start from the VSFs that the municipality in question is responsible for, including municipal companies, or alliances (SFS 2006:637). Every municipality is responsible for identifying VSFs within the municipality (MSB, 2021d).

4. Methodological Approach

4.1 Research Design

The study used a qualitative research design to explore the research aim and questions. Qualitative research is arguably useful to capture details, complexity, and the context in which municipalities analyze critical dependencies (Creswell W., 2013, pp. 47-48). More specifically, the approach of qualitative research that has been used in this thesis is an intrinsic case study with a focus on the case and the process in itself (ibid.: p, 100). Case study research allows the study of specific entities and processes in current real-life cases, and it allows for an in-depth understanding by integrating several data collection methods. This thesis adopted a combination of a document study and interviews, which later was aggregated through a thematic analysis to allow for emphasis on similarities and differences across the analyzed cases (ibid., pp. 97-99).

4.2 Document Analysis

The document analysis of municipal RVAs was used as a way of framing the context and setting of how municipalities work with critical dependencies (Bowen, 2009, p. 30). It is considered an effective method (ibid., p. 31), but to triangulate data and seek convergence, the study also draws on interviews. The studied RVAs correspond to the interviewed municipalities and only RVAs created for the most recent period, 2018-2022, have been used. All documents included in the study were collected directly from the municipalities' websites or were shared by the interviewees before the interviews in those cases the RVAs were publicly available without a confidentiality check. Due to this reason, the number of studied documents is lower than the number of conducted interviews. In total, 12 documents have been analyzed and the studied municipal RVAs range from approximately 20 pages to 50 pages.

The analyzed documents are presented anonymously in the table below. This table is connected to Table 6, meaning that municipality A in Table 5 is the same municipality as municipality A in Table 6 below.

Table 5 – Studied RVAs and geographical information

Risk- and Vulnerability Analysis	Geographical Location	Size of Municipality
Municipality A	Center	Middle
Municipality B	South	Middle
Municipality C	South	Small
Municipality D	Center	Small
Municipality E	South	Middle
Municipality F	Center	Middle
Municipality G	South	Large
Municipality H	South	Middle
Municipality I	South	Middle
Municipality J	North	Middle
Municipality K	South	Large
Municipality L	South	Middle

4.3 Interviews

Interviews were used as a complementary method to the document review, to be able to ask questions about what was found to be lacking from the RVAs. In total, 73 persons from 62 municipalities were contacted and 16 interviews were scheduled with 16 municipalities from nine out of Sweden's 21 counties (SCB, n.d.). When contacting the municipalities, an approach of purposeful maximal sampling of the cases and interviewees was used (Creswell W., 2013, p. 100, 156). The thesis strived to receive an even distribution of interviewees from small, middle, and large municipalities from the north, center, and south of Sweden to capture municipalities with eventual access to different resources. The size categorization of municipalities that have been used in this study is the following; small municipalities are counted as having less than 15 000 inhabitants, middle-sized municipalities as having 15 000 – 90 000 inhabitants, and large municipalities as having more than 90 000 inhabitants (MSB, 2012, p. 7). However, the response rate from the contacted persons varied, and this ambition could not be fulfilled in this study. Consequently, middle-sized municipalities from the South of Sweden are overrepresented.
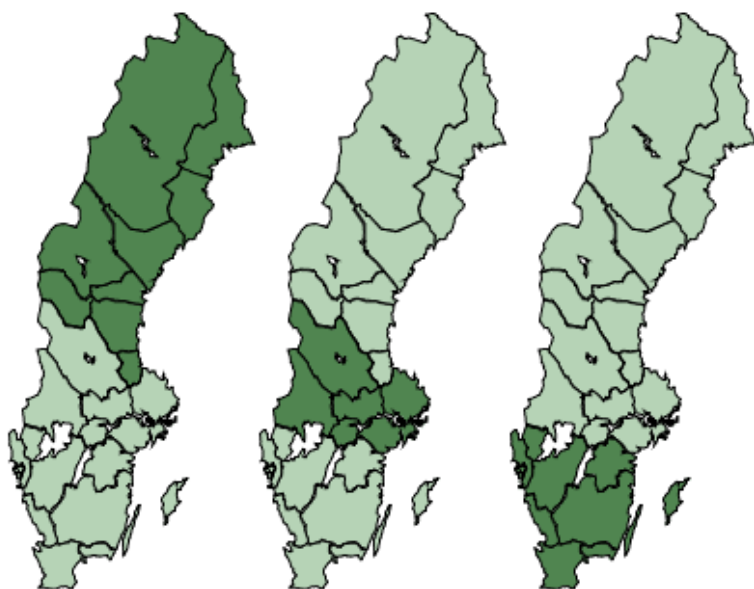
Figure 2 – Picture showing the north, center, and south parts of Sweden in dark green. The lines in bold indicate Sweden's counties. Picture adapted from Wikimedia Commons.[10]

Furthermore, the purposeful sampling also included which actors were contacted within the municipalities. Firstly, staff with the title Preparedness Coordinator[11] were contacted, and secondly staff with the title Security Coordinator[12]. For smaller municipalities, it may be that no staff with this title exists, and in that case staff with the title Head of Security[13] were contacted. Staff with these titles are most often responsible for the RVA process in the

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[10] The picture consists of three separate pictures edited into one. The original pictures were created by the user *Lapplänning* on Wikimedia Commons and the licenses to the pictures are found here:
https://commons.wikimedia.org/w/index.php?curid=5899342
https://commons.wikimedia.org/w/index.php?curid=5899421
https://commons.wikimedia.org/w/index.php?curid=5899434
[11] The original term in Swedish is "beredskapssamordnare".
[12] The original term in Swedish is "säkerhetssamordnare".
[13] The original term in Swedish is "säkerhetschef".

municipality (Hedtjärn Swaling et al., 2016, p. 28, 68). Some municipalities are using variants of these tiles, such as combinations of titles. These were also included in the search. The purposeful sampling was used to ensure that the interviews would be conducted with staff within municipalities that should be familiar with the work surrounding RVAs and critical dependencies.

All municipalities from which a representative was interviewed will be presented anonymously in the table below. The decision to only present the results anonymously was made to ensure that the interviewees would feel like they could speak freely about the topic of critical dependencies. A further discussion on confidentiality surrounding RVAs, CIs, and VSFs is found in section 6.5, limitations of the study.

Table 6 – Interviewed municipalities and geographical information

Interviewed Municipalities	Geographical Location	Size of Municipality	Length of Interview (mins)
Municipality A	Center	Middle	33,29
Municipality B	South	Middle	45,07
Municipality C	South	Small	40,58
Municipality D	Center	Small	39,26
Municipality E	South	Middle	37,54
Municipality F	Center	Middle	46,56
Municipality G	South	Large	49,21
Municipality H	South	Middle	37,33
Municipality I	South	Middle	48,38
Municipality J	North	Middle	46,49
Municipality K	South	Large	39,36
Municipality L	South	Middle	44,46
Municipality M	South	Large	33,03
Municipality N	Center	Large	53,59
Municipality O	Center	Small	60,24
Municipality P	North	Small	43,54

For the interviews, a semi-structured approach with open-ended interview questions was used to facilitate discussion and to capture a broad view of the research problem. The semi-structured approach also allows for follow-up questions when necessary and for discussing related aspects of the topic (Kvale & Brinkmann, 2014, p. 172). The interviews always started with some general questions to facilitate trust between the interviewer and the interviewee. After that, questions regarding the four research questions were asked. The thesis's research questions were operationalized according to the four areas driven by the conceptual framework of risk governance and risk management. The four overarching themes were not always presented to the interviewees in the same order, depending on what the interviewee had brought up already during the interview (ibid.). The interview questions were not sent out to the interviewees before the interview. This decision was made because it had already been established that the interviewee had knowledge about the topic. The interview guide can be found in Swedish in Appendix A and English in Appendix B.

All interviews were conducted as individual interviews during May and June 2022. Due to the geographical spread of the interviewees, the interviews were conducted online through the digital meeting platform Zoom. It was possible to cover a larger geographical area for the interviews by not conducting the interviews in person, but online interviews may affect trust and possibilities for the interviewer and interviewee to connect (Irani, 2019). The interviews were recorded and transcribed from the recordings by the author of this thesis using intelligent verbatim transcription. This ensures readability but also that no valuable information was lost in the transcription process (McMullin, 2021).

4.4 Method of Analysis

The process of analyzing documents and interview transcripts contains three major steps, namely a superficial examination of the material, followed by a thorough examination, and lastly interpretation (Bowen, 2009, p. 32). For a more specific analysis of the data, a thematic analysis as described by Braun & Clarke (2006, p. 16-23) was used to identify and analyze patterns within the collected data (ibid., p. 6). Thus, this study followed six steps of data management:

1. Familiarization with the collected data
2. Coding of the data
3. Searching for themes in the codes
4. Reviewing the themes
5. Defining and naming themes
6. Writing the results and interpretation

The thematic analysis was done using the software NVivo 12. This study has used an inductive thematic analysis with semantic themes in line with Braun and Clarke's (2006, pp. 12-13) description which allows for a data-driven analysis with no pre-defined codes or themes. However, the study is also limited to constructing codes and themes from the data available in the documents and the interview transcriptions (Bowen, 2009, p. 32). The process of searching for themes is not strictly linear and due to the amount of data provided by the interviews in this study, the six steps of data management were revisited multiple times (Braun & Clarke, 2006, pp. 15-16, 20). The RVAs used for the document study and the interview transcripts were first coded separately. When all the RVAs and interview transcripts had been separately coded, the codes were compared and analyzed together through an identification of patterns across codes. Some codes that were first deemed interesting were sorted out due to a lack of a clear connection to the research questions. The remaining codes were then grouped into themes and to allow for themes to be merged, divided into two, or to be sorted out due to too little or diverse data, the themes were reviewed several times. In the end, through the thematic analysis, ten themes that were deemed relevant for the aim of this research were identified. These themes will be presented in Chapter 5.

Since the analyzed documents and the interviews were in Swedish, the codes for the interpretation of the data were first constructed in Swedish and later translated into English. This was made to try to ensure that no nuanced differences would be lost in the coding processes. Words and concepts may not always have the same meaning or encompass the same

distinctions across languages. An interpretation of the data follows in Chapter 6 of this thesis. It is necessary to emphasize that all types of qualitative research have to adjust for the fact that it is dependent on the researcher's interpretation of the analyzed material (Bengtsson, 2016, p. 8).

5. Results

In this chapter, the results from the aggregated analysis of the document review and the interviews will be presented. As discussed above, the municipalities will only be presented anonymously and no direct quotes from the participants will be used. Instead, the results are connected to Tables 5 and 6 in which information about municipality size and location is found. This is to promote as much transparency as possible.

Table 7 – Overview of results

Overview of Results	
Theme 1	Acquiring Correct Data for the Analysis of Critical Dependencies
Theme 2	Collaboration with Other Actors
Theme 3	Deciding Delimitations and the Lack of Clear Boundaries
Theme 4	Similarities in Analyzed Dependencies and Risks
Theme 5	Different Choices of Approach
Theme 6	Regulations and Added Value
Theme 7	Follow-up of the Analysis
Theme 8	Access to Resources and Differences Between Municipalities
Theme 9	Lack of Institutional Memory
Theme 10	A Need for Better Support and Guidance

5.1 Theme 1 – Acquiring Correct Data for the Analysis of Critical Dependencies

The aggregated data shows that in nine of the municipalities in the study the RVA and analysis of critical dependencies are conducted by the municipal administration or the preparedness coordinator in coordination with the municipal administration. However, the municipalities in the study also mentioned the importance of working together with the municipal activities. Moreover, the municipalities that answered that the analysis is driven by the municipal administration motivated this with the municipal administration having the most information about the activities they are responsible for. Thus, they are able to capture relevant information about the actual activities.

Furthermore, based on the results of the interviews, all 16 interviewed municipalities answered that their analysis of critical dependencies is carried out in close connection to the municipal activities. This means that the RVA analysis may not be carried out by civil servants working for the municipalities' administrations, but that employees working directly with the municipal activities can have responsibility. For example, municipalities F and J answered that the activities are either responsible to make their own RVA, or that a stated goal exists within the municipality that the activities should make their RVA. Thus, schools, elderly homes, and other municipal activities conduct their own RVA, and the analysis is managed by people with knowledge about the day-to-day business of the activities. A reason why the municipalities want the analysis to be carried out by the municipal activities seems to be the perception of the municipal activities having the most knowledge about their everyday business. For instance, municipality P stated that the RVA should be the municipal activities' responsibility since they are the ones closest to the everyday business. Municipality M described that it is of the highest importance that the ones working within the activities report what they see as critical

dependencies, since it may be difficult for someone else to capture that same information. In sum, even though it may differ between municipalities who or what actor is responsible for the analysis of critical dependencies, this study implies that the most important factor to take into consideration is to capture knowledge about the municipalities' everyday business.

5.2 Theme 2 – Collaboration with Other Actors

Whether municipalities are collaborating or not with other actors in defining and analyzing critical dependencies appears to vary across municipalities. Data from the document study show that three municipalities (C, D, and P) are actively collaborating with other municipalities in the RVA process. Municipality P further mentioned that unofficial collaborations on the RVA have been prevalent, in terms of seeing how other municipalities are working with the RVA and what information is included in the published RVAs. Two other municipalities (I and K) stated that they collaborate with other municipalities within the same county, particularly with the planning of the RVA. However, the RVA process entails more than only analyzing critical dependencies, and no further explanation on how that collaboration looks were given.

On the contrary, nine of the interviewed municipalities stated that there is no existing collaboration with external actors outside of the municipality in the process of analyzing critical dependencies. Municipality L explained that the reason for this is the confidentiality of information surrounding critical dependencies. Though, they also expressed that it would be possible to invite external actors to create their own analyses of critical dependencies. Similarly, municipality H expressed that it could become relevant for them to invite external actors to the analysis in the future, though no further explanation of that thought was given. Another municipality described that they had taken part in an external actor's workshop on the topic of critical dependencies, but that this was not something happening regularly. Other parts of the data show a range of other actors being invited to the process of analyzing and mapping critical dependencies. Municipality O explicitly stated that the municipality is not working in a silo and that cooperation with external actors is important, especially when a municipality is depending on a lot of goods coming into the municipality from outside its borders.

What an "external actor" is to a municipality may look different across municipalities. External actors could for example be supermarkets, fuel providers, regional health care facilities, rescue services or electricity companies. Not all municipalities have the same activities within their responsibilities and may therefore be dependent on interacting with different types of external actors. This was evident when the interviewees talked about companies, which in some cases can be owned by a municipality. Ownership of companies may also be shared between municipalities, and this can create requirements for cooperation between municipalities. Some municipalities (D, H, and N) related to this by expressing a willingness to deepen the cooperation with municipal companies and mentioning specific companies within the municipalities with which they wanted to create further cooperation. Municipality N described a newly started process of cooperation with their municipal companies.

However, municipality L described that many of the municipality's services are outside the municipal organization, and these are not necessarily considered during the analysis of critical dependencies. The fact that the services are outside the responsibility of the municipality also

creates difficulties for recognizing necessary measures. It was also expressed that it could be useful to be able to compare knowledge about critical dependencies with external actors, to better ensure their continuity and deepen cooperation. In connection to this, municipalities I, J, and O expressed that there is a possibility for a municipality to control and include external companies and their analysis and knowledge of critical dependencies since this can be included in procurement processes.

When asked if the municipalities are working together with any other actor in the analysis of critical dependencies, seven of the interviewed municipalities also mentioned the county board. However, the answers differed in the expression of how much they were working together with the county board, ranging from "not so much" to "very good cooperation". Municipality O explained that this cooperation is dependent on whether the county board takes on an active role and that this often varies across the country. In some cases, municipalities seemingly self-organize and create foundations for cooperation on their own initiative when the county board is not providing this opportunity sufficiently. The data furthermore shows that two municipalities (C and K) are actively working with the region, especially regarding questions related to health care since the region is responsible for large parts of health care in Sweden. In sum, no clear patterns can be seen in the data related to collaboration for analyzing critical dependencies in the RVA process.

5.3 Theme 3 – Deciding Delimitations and the Lack of Clear Boundaries

The coded data shows that a third of the interviewed municipalities have difficulties deciding the delimitations of the analysis of critical dependencies within the RVA process. For instance, one municipality (G) explicitly mentioned that it is difficult for the municipality to know how detailed the analysis should be made. In accordance with this, municipalities A, J, and M described that an analysis beyond the most obvious critical dependencies is lacking but that information on further interdependencies would be desirable to include in the general analysis. Dependencies of other municipalities were specifically mentioned since this could also affect other municipalities. However, as seen in theme 2, no clear-cut collaboration between municipalities in defining critical dependencies has been detected, though municipality E described that this delimitation had been discussed and anchored within the municipal management. Moreover, two municipalities described the complexity of critical dependencies as the biggest challenge, since the complexity adds to the perception that there is no clear end to an analysis of critical dependencies. In connection with this, the process of the analysis was described as overwhelming (N), and it may be difficult for municipal activities to take on (D).

The lack of clear boundaries to the analysis was also related to areas of responsibility. Seven municipalities explicitly expressed a feeling of ambiguity in areas of responsibility, and municipality E emphasized a gap between municipal and national work on critical dependencies. Similarly, municipalities C and G said that some dependencies may not be the municipalities' responsibility, but rather should be analyzed on a national level. However, this also goes the other way around - one municipality (G) mentioned that it may be difficult for municipalities to see the bigger picture related to critical dependencies, due to a lack of information and understanding about regional and national levels.

5.4 Theme 4 – Similarities in Analyzed Dependencies and Risks

Despite Theme 3 showing difficulties with delimitations and expressions of the analysis being too complex, the combined data from the document review and the interviews show that most municipalities are analyzing the same types of critical dependencies. Ten of the 12 analyzed documents and six out of 16 interviews mentioned electricity as a critical dependency for many of the municipalities' VSFs. Seven documents and four interviews mentioned IT and the internet, and it was discussed that IT dependencies will become stronger in the future. Eight documents mentioned water, six documents and six interviews mentioned staff, and five documents mentioned the heat supply. However, the interviewees more often related to the analyzed dependencies as "overarching" and did not mention any specific dependencies. This was described with that they focus on the most obvious dependencies for the municipality or what was described as the "most common" dependencies.

Moreover, three municipalities (B, D, and L) described critical dependencies as something static which are not changing, and one municipality (L) stated that no deep analysis is needed to find the critical dependencies. Simultaneously, three other municipalities (F, K, and N) described them as changeable and explained that new dependencies can arise in the future. Municipality N also stated that further deeper work with critical dependencies is necessary. Thus, the results show a split vision of critical dependencies related to how they work and whether they can change or not.

For analyzed risks, meaning what could happen to affect or discontinue a critical dependency, the aggregated analysis shows that seven of the studied municipalities declare that specific risks are not always important for the analysis of critical dependencies. For example, municipality D stated that the cause of disruption is not as important to analyze as the consequence of the disruption. Similarly, municipality K explained that their analysis does not focus on what creates discontinuation, but the analysis sees what the actual dependencies are.

5.5 Theme 5 – Different Choices of Approach

For the general process of conducting an RVA, municipalities can use different approaches to receive results. The data from the aggregated analysis shows that there are typically three major approaches that municipalities use for the RVA and for analyzing critical dependencies. These three approaches are either to use a pre-defined method called FORSA which is distributed by the state, to work with what is called continuity management, or to work more freely based on a pre-defined method.

The choice to use the pre-defined method FORSA was explained by its perceived helpfulness in the identification of critical dependencies within the municipality, and that it in general suited the municipality's work with crisis preparedness (D and N). One municipality pointed out that this method has been recommended by MSB (N). Four municipalities also mentioned that they use the support material and information which can be accessed from MSB to tackle the RVA process and the analysis of critical dependencies (B, C, E, and P).

The second pre-defined method which was mentioned in the aggregated data was continuity planning. Municipality B explained that while ensuring continuity of municipal activities

critical dependencies are consequently taken into consideration. According to the interviewee, continuity planning may help develop measures for critical dependencies since they believe the process may bring out different aspects of dependencies. Another municipality (A) described that their RVA process builds on continuity planning that has been conducted before the RVA process starts.

However, the data shows that the most common approach to analyzing critical dependencies is for municipalities to develop their own method. This can be done by either making alterations to the FORSA approach (B, D, L, and N), or by taking inspiration from other municipalities' ways of work (A, G, I, J, and M). Another municipality (F) expressed that altering or creating a method suitable for the municipality ensures the inclusion of the right information. One municipality (J) mentioned that they believe that a well-integrated method can be helpful to tackle the problem of a lack of institutional memory (see theme 9). In this municipality, the method has been used for such a long time that the involved actors have a conception of how the method is supposed to be used and what end results are expected. If a new method would be introduced to the municipality, the municipality would have to reestablish ways of working and it would become more dependent on individual employees to facilitate the change of method.

Furthermore, municipality A discussed collaboration between municipalities, especially between municipalities within the same county, in the choice and use of a certain method. This was explained to help with providing a more uniform accounting and then be able to reach an increasing consensus on terminology within crisis management, risk analyses, and critical dependencies. The argument for this is that it can help provide a more stable ground for RVA-related work across the county.

5.6 Theme 6 – Regulations and Added Value

The data shows that the municipalities are mostly relating to the *Act on measures taken by municipalities and county councils before and during extraordinary events in peacetime and heightened preparedness* when it comes to the analysis of critical dependencies. Nine out of 12 documents explicitly mentioned this law. The aggregated data shows that 12 municipalities mentioned that this law is what enforces the work with critical dependencies within the municipality, the work is being done within the municipality because they must meet the legal requirement. Four municipalities (B, J, O, and P) appreciated how the law concretizes and delimits the work. However, the data also shows that some municipalities (D, E, and L) do not see how this law would affect the work with critical dependencies and mention that previous hazardous events affect the work within the municipality much more than what the law does since it highlights weaknesses and needs. Furthermore, the aggregated data shows that the law may be secondary to the perceived benefit of the work.

The perceived benefits and added value of the analysis of critical dependencies create a will among municipal administrations to take the analysis further. Ten municipalities expressed that the analysis of critical dependencies contributes to the municipality's overall crisis preparedness. The analysis enables the municipalities to create a pre-understanding of daily activities and what dependencies they may have, together with a possibility to consider

alternative solutions to eventual problems and this may create a sense of security within the municipal administration and the activities (A). The analysis helps the municipal activities to get to know its operations better and it can be used for further crisis management and preparedness within the municipality. Continuously, eleven municipalities expressed that knowledge of critical dependencies is important or very important for the municipality since the analysis helps the municipality to fulfill its mission toward citizens and the state (F). Some municipalities also expressed that the analysis of municipal critical dependencies may contribute to national preparedness and protection of VSFs.

The aggregated data shows that nine municipalities believe that also MSB's regulations affect the work with critical dependencies, especially since the regulations direct how the disposition and reporting of the RVA should look like. On the same note, there do not seem to be any clear incentives in laws or regulations to work with critical dependencies (C, I, L, and N). However, some municipalities find financial means, or the risk of not getting financial support, as an incentive from the state to work with critical dependencies. According to municipality A, analyzing critical dependencies is time-consuming and financial support is therefore necessary for the municipality. Moreover, 13 out of the 16 interviewed municipalities state that they do not see any hindrances in laws or regulations for the municipal work with critical dependencies. One municipality (H) also mentioned that they do not see any hindrances in working more with critical dependencies than what laws and regulations advocates.

5.7 Theme 7 – Follow-up of the Analysis
The data from the aggregated analysis shows a diverging result on how and if the municipalities work with measures and follow-ups of the analysis of critical dependencies. A few municipalities (A, C, E, F, J, L, and O) stated that they are revising and updating the analysis of critical dependencies every fourth year, in connection to the general RVA process. During this process, the municipalities have the chance to look through what was done the last time, and if something needs to be changed for the next RVA.

Moreover, some municipalities (A, B, D, G, J, K, and N) also said that they work or try to work with a yearly follow-up. Striving towards a constantly ongoing process with yearly follow-ups allows for more thorough work with identifying new risks and making sure necessary measures are taken and carried out. A continuous process should also ensure that the RVA and the analysis of critical dependencies do not only become a paper product that is never read or used. This especially benefits the municipal administration and activities since they are given the chance to constantly improve their operations.

However, the data show that municipalities sometimes have difficulties with regular follow-ups (A, B, and M). For example, there may not be someone responsible for the analysis and the follow-up, there is a perceived lack of interest from the municipal management, or one thinks that most of that work goes in line with the municipal activities' daily work and therefore no clear-cut follow-up is needed.

Due to confidentiality reasons, the collected data did not provide information on specific measures that municipalities are working on in relation to critical dependencies.

5.8 Theme 8 – Access to Resources and Differences Between Municipalities

The data for this study shows large differences between municipalities' access to time, resources, and knowledge to produce an analysis of critical dependencies. The data further shows that 11 municipalities seem to agree on the fact that a lack of access to resources makes the process of analyzing critical dependencies more difficult. One municipality (A) pointed to the fact that analyzing critical dependencies takes a lot of time. The same municipality highlighted that the only way they believe they can keep on track with the work that needs to be done, and specifically to keep the analysis up to date, is through cooperation with other municipalities. However, municipality P mentioned that cooperation between municipalities also requires resources and can thus be difficult to realize if the municipality is very strained on resources from the beginning.

It was also mentioned by another municipality (L) that they find it impossible to go through with the level of detail in the analysis they feel is expected of them from MSB and the state. They also stated that they believe that no municipality has the time to work with everything that is expected from them. Three municipalities (B, F, and I) mentioned that a lack of time hinders follow-ups on the analysis of critical dependencies, as well as the implementation of necessary measures. Municipality A mentioned that the problem with a lack of time is not only among the preparedness coordinators but also within the municipal activities which, as demonstrated in Theme 1, often are responsible for the actual analysis of critical dependencies. This was echoed by the interviewee from municipality D who stated that they as preparedness coordinator does not know if or how the municipal activities are conducting follow-ups on their own analyses of critical dependencies. Rather, this is left to the activities to do if time and resources allow for it.

The perceived lack of time is arguably connected to broader mentions of "lack of resources". Some municipalities mentioned staff as a key resource that is often lacking which could result in no one having the time to analyze critical dependencies, or that available staff do not have the training to complete such an analysis. Municipality B explained that the staff working within the municipal activities most often are not working administratively with tasks resembling analyses of risks and vulnerabilities, creating a knowledge gap in the RVA process. The data also shows that municipalities of different sizes have different possibilities to gain access to resources (A, C, N, and O). This was related to both access to staff, how well the work is connected to the municipal management, and the possibility for the preparedness coordinator to support the municipal activities during the process of the analysis.

Many municipalities are not financing the preparedness coordinator on their own. Rather, they are dependent on financing from the state. During the interviews, several interviewees talked about the issue of financing necessary measures for critical dependencies or making investments in general crisis preparedness measures. This is not necessarily connected to the process of analyzing critical dependencies for the municipal RVA but is connected to the municipality's ability to deal with the dependencies they have. The financial support municipalities receive from the state to work with crisis preparedness is regulated through an agreement between MSB and SKR. Some municipalities (D, O, and P) voiced concern about

this agreement, finding it difficult to not be able to use the financing for what they believe is most valuable for the municipality. This was related to a statement on a perceived skewed distribution between bigger municipalities, especially cities, and smaller municipalities (O).

Tying this data together, municipalities have a common view on the importance of access to resources to be able to conduct good analyses and to continuously keep the work active even during the years in between the RVA process. Time and staff were mostly mentioned, but this is also indirectly related to the challenge of receiving financing to keep enough staff and to be able to use the people with the right knowledge for the analysis. The data further indicates that access to resources looks differently across the country depending on for example the size of the municipality, with smaller municipalities more often mentioning a lack of resources as a problem.

5.9 Theme 9 – Lack of Institutional Memory

There seems to be an overarching recognition that one of the biggest problems within the process of analyzing critical dependencies is that most of the work is dependent upon one person with knowledge about the topic. Four municipalities (D, F, H, and O) explicitly mentioned the dependence on individual staff as a challenge to the process. The weakest link within a process could be either a municipal activity or key staff and such functions are always maintained by a person. If that person quits or is no longer available due to rotations of staff within the municipal organization, there is a risk that the knowledge this person has is not transferred to someone else or a successor. Another municipality connected the dependency on the person to the choice of method for the process of analysis, and that different people prefer different ways of working. Municipality H connected it further to the possibility of engaging the "right" people within the process. As Theme 1 described, the data demonstrates that many municipalities want the municipal activities to have the responsibility of the analysis possible since the common conviction is that the most knowledge and the most suitable staff to conduct the analysis are there. Thus, the challenge described in this theme connects to finding and being able to engage that knowledge and bring it into the process. A fourth municipality (F) related this challenge to the municipal administration which is responsible for budgets and political decisions. The municipal administration and managers within the administration must be involved in the RVA process to enable financing and decision-making connected to critical dependencies. However, since the municipal administration is not the responsible entity to conduct the analysis, keeping the administration enough involved has sometimes proved to be a challenge.

Municipality B, a smaller municipality, particularly emphasized this issue and stated that if the right person is not in place or if they are not available the analysis of critical dependencies will be affected. Without the right knowledge, there is a risk that certain critical dependencies are not accounted for in the analysis. This interviewee described that the municipality's activities are present during the analysis and that the analysis should be based on the needs of the respective activities. Though, some activities may create deeper and more extensive analyses than others if there is someone within the organization of the activity with extra knowledge or interest in the question. Another municipality (B) explained that this is a problem within

municipalities with only one preparedness coordinator since it can be more difficult to receive attention from the municipal management.

During the interviews, many of the interviewees that introduced themselves as new to their position within the municipality mentioned that they do not know about what their predecessors had been working on concerning the RVA process and critical dependencies. On the other hand, some interviewees mentioned that they had been in the same position for a longer time. Having one employee staying in the same position could theoretically be connected to the problem of a lack of institutional memory since knowledge and information could depend on one individual. Nonetheless, the data from this study do not cover and did not aim to explore how or if the municipalities actively work with securing information to future employees to improve the institutional memory.

5.10 Theme 10 – A Need for Better Support and Guidance

There was consensus amongst the informants regarding the need for more and better support and guidance in the RVA process and the analysis of critical dependencies. Theme 1 showed that some municipalities have, or strive to have, the analysis to be conducted by the municipal activities. This would mean that the preparedness coordinator, whose job is to coordinate the RVA process and is often the person with knowledge about methods and regulations affecting the analysis, or the civil servants in the municipal administrations, may not be responsible for the actual analysis of critical dependencies. This indicates that the analysis done by the municipal activities is not conducted by persons who are experts within the field of risk, vulnerabilities, and critical dependencies.

Several municipalities (B, D, G, K, and N) mentioned that they support the municipal activities in the analysis via the preparedness coordinator. The data also demonstrates that municipalities are already simplifying the technical language and guidance provided to the people doing the analysis within the municipal activities (L and M). Some municipalities (M, N, O, and P) pointed out that they do not use the term "critical dependencies" within the municipality to avoid confusion among other municipal staff, and that the preparedness coordinator and the municipal activities may not have the same picture of what dependencies are critical. Municipalities perceive existing guidelines and guidance for the analysis of critical dependencies to not be customized to the ones managing the analysis. Some are already working on creating their own guidance from the nationally available guidelines and from their own way of working. However, it is clear that the municipalities wish for further support in this and that they believe that the existing guidelines are somewhat misdirected.

6. Discussion

This chapter discusses the findings from the aggregated document and interview study. The results are arguably interconnected to a great degree and benefit from being discussed together to allow for further exploration of how municipalities analyze critical dependencies. Therefore, to facilitate a discussion of the thesis' four research questions, the discussion presents four categories relating to different aspects of the study's research questions. However, section 6.1 mainly focuses on RQ 1, 2, and 3, section 6.2 mainly focuses on RQ 1, and 2, section 6.3 mainly focuses on RQ 3, and lastly section 6.4 mainly focuses on RQ 3 and 4.

The discussion also attempts to position the findings into a broader perspective linked to the conceptual framework of risk governance, risk management, and infrastructure interdependencies and relates to previous studies. Furthermore, the chapter includes a discussion on limitations and the possibility to generalize the results of this study. Seeing that this thesis focuses on critical dependencies in relation to the municipal RVA process, many results seem to go in line with previous studies on municipal RVAs, such as Eriksson (2016) and Cedergren et al. (2019).

6.1 Identification of Critical Dependencies

The findings show that the municipalities in the study are seeking to conduct the analysis within the municipal administrations or municipal activities to engage staff with the right knowledge. The municipalities' preparedness coordinators, or staff with similar titles and areas of responsibilities, are intrinsically responsible for the RVA and that all necessary steps for an RVA are taken (Hedtjärn Swaling et al., 2016, p. 28). Knowledge is an important aspect of new risk perspectives on risk assessments and management (Tehler, 2020, p. 27). Probability and consequence judgments can only be based on adequate background knowledge and knowledge is considered an inherent part of the risk analysis (ibid.). This aspect of analyzing risk can be seen as obvious, but in municipal analyses of critical dependencies, it is arguably a necessity to combine different knowledge when the analysis is conducted. As seen in Theme 1, the municipal activities may have knowledge about dependencies, but the preparedness coordinator may be the only one with knowledge of how those dependencies are supposed to be mapped.

A study from 2011 (MSB, p. 10) proposed that the division of responsibilities in the RVA process and mapping of critical dependencies have been focused around more "central" entities of the municipality, but also on the level of the municipal administration. The study exemplifies the "central" level with a group of representatives from different municipal administrations (ibid.). The findings in this thesis (see Theme 1) suggest that the division of responsibilities may have shifted somewhat to encompass the municipal activities more directly rather than being at a central level. However, this does not imply that the central level is no longer having a role in the analysis of critical dependencies. Rather, it is apparent that the preparedness coordinator and the municipal administrations have focused roles in administering the analysis (see Themes 1 and 10).

Nevertheless, the responsibility of municipalities' activities analyzing critical dependencies also highlighted the problem of knowledge as discussed above. There is also a perceived problem with a lack of time and resources for preparedness coordinators to support the

municipal activities in the analysis. This challenge was lifted mostly by the interview participants (see Theme 8). Eriksson (2016, p. 33) showed that it previously has been noted from county administrative boards that larger municipalities often have access to more resources. With access to more resources in the RVA process, larger municipalities may have better prerequisites to do better and deeper analyses than smaller municipalities. Furthermore, Eriksson also emphasized that the problem of access to resources affects municipalities' possibilities to use the analysis of critical dependencies and to apply measures that have been identified as necessary (ibid., p. 37). Hence, access to resources in the municipal RVA process does not seem to be a recent problem. In general, municipal resource allocation is a somewhat troubled process since the municipalities have to be able to fulfill their mission toward the state and the citizens (Klintbo et al., 2007). This thesis will not handle this problem in detail since it arguably lies outside of the scope and aim of this study. Nevertheless, it is relevant to highlight the differences between municipalities and their access to resources since it affects the possibilities of creating far-reaching analyses of critical dependencies and affects municipalities' possibilities to use and learn from the analyses.

6.2 Benefits and Challenges of Collaboration

Mechanisms of cooperation, information-sharing, and other types of collaboration are important in the study of dependencies and interdependencies (Rydén Sonesson et al., 2021, p. 4). As seen in the results, some municipalities are actively collaborating with other municipalities, while others are expressing that this happens less frequently. A study from 2011 on municipalities, county administrative boards, and national authorities' work with RVAs mentioned the same result and describes collaboration within counties (MSB, 2011, p. 14), which also this thesis show in Theme 2 – particularly in relation to cooperation within the RVA process as a whole. However, during the ten years that have passed since the MSB study was published seemingly no solutions to the skewed collaboration have emerged. Collaboration often emerges when actors see mutually advantageous solutions or perceived improved efficiency from combining knowledge and resources and Theme 2 presents that the collaboration sometimes has been self-organized. Networks such as the ones of collaboration within counties may not be static, but they can change and adapt (Rydén Sonesson et al., 2021, p. 8). Thus, it could be possible to argue for a need for more hands-on network building to adapt existing collaboration networks. This would ensure the inclusion of all municipalities across Sweden and create a basis for easier and deeper knowledge-sharing. Though keeping up networks may be time- and resource-consuming for the municipalities (see Theme 8), but better access to knowledge and information-sharing could be a way to save resources in the long run and thus receive more time for other work.

Furthermore, some municipalities express an interest to involve other actors that are not involved in the process of analyzing municipal critical dependencies today. This is seen in Theme 2 which concerns the involvement of external actors. According to the IRGC framework of risk governance, involving a multitude of actors may create opportunities for finding strategies to address certain risks (IRGC, 2017, p. 11). However, including external actors may be difficult due to the confidentiality of information. Even though there may be a range of positive aspects of integrating many different actors in the analysis and management of critical dependencies, it may not be possible to foster a broad collaboration with external actors due to

restrictions on information spreading. The OECD recommendation for good risk governance (OECD, 2014) promotes transparency, accountability, and learning from research and experience. Further collaboration between municipalities may help encourage deeper learning from each other, but to be transparent is, again, surrounded by difficulties when it comes to critical dependencies.

Nonetheless, the study by Eriksson from 2016 (p. 47) showed that municipalities often hire external consultants as support during the RVA process, though this was not evident when the municipalities in this study were asked about external actors in the process of analyzing critical dependencies. This could either indicate that municipalities have become more aware of security issues in their work since the study was released in 2016, or that municipalities hire external consultants during the RVA process but are not including them in the analysis of critical dependencies. This could be a logical explanation seeing the problem with confidentiality surrounding critical dependencies.

However, further collaboration on critical dependencies between municipalities may be necessary to discuss based on today's conditions. The results of this study show that some municipalities find it essential to be able to analyze critical dependencies in more detail than what they do today. This is in itself surrounded by complexity and will only somewhat be discussed here, but it can also be interesting to see how this potentially could affect cooperation and information-sharing mechanisms. If the analysis moves to a more detailed and complex level for all municipalities in Sweden, possibilities for cooperation in the analysis of critical dependencies may be affected because of the confidential information surrounding critical dependencies. The focus of cooperation could instead be on the methods used for the analysis, which will be discussed in section 6.4.

6.3 The Complexity of Critical Dependencies

It is known that dependencies and interdependencies of CIs create difficulties for those wanting to study them (Svegrup et al., 2019). CIs are complex adaptive systems, which can have emerging behaviors during for example a disruption. Thus, infrastructures are more than the sum of their component parts and need to be studied with this complexity in mind (Rinaldi et al., 2001, p. 13). Another factor contributing to the complexity is that CI is divided among many different actors in society, both private and public owners on different levels of society (MSB, 2017, p. 8). However, even though municipal VSFs potentially could be associated with being complicated rather than complex, meaning that the structure may be closed with more clearly defined boundaries rather than having emergent behaviors, they may still have a large number of components that are highly connected (Kröger & Nan, 2014, p. 280). Either way, this foundation of either complicatedness or complexity is immensely difficult for municipalities to study.

The results of this study show that municipalities rarely analyze critical dependencies beyond the most obvious dependencies. Arguably this means that the analysis may not be able to accommodate a complicated system with a large number of factors and many levels of dependencies even though it may have somewhat clear boundaries. Hence, a complex system with emerging behaviors could be even less likely to be accommodated. The reason why the

analysis does not go further seems to be because of for example the ability to access financial and staff resources; but also, because the municipalities are not required to draw the analysis outside of the responsibilities within their geographical area (MSBFS 2015:5). This may create an unstable basis for generating knowledge about critical dependencies. According to Tehler (2020, p. 23), it is insufficient to analyze limited parts of risks and the systems they are in. The municipal analyses of critical dependencies do not seem to be on the holistic level risk management theory is advocating (Aven & Renn, 2010, p. 56). Nevertheless, it is important to discuss whether the municipal level is the best location for such large-scale analyses or if this could be positioned at a regional or national level instead. Cedergren et al. (2019, p. 791) suggested that if certain parts of the more "generic" analyses in an RVA could be lifted to the county administrative board, or the national level, it would allow municipalities to spend more resources on analyses beyond the most obvious dependencies but with a more local focus. Such attempts may be hindered because of confidentiality reasons surrounding information on critical dependencies, since aggregating data on dependencies may compromise the protection of public interests and VSFs (ibid.). However, this thesis suggests that there already is a common view on dependencies and risks in the studied municipalities and much information is publicly available, either through municipalities' open versions of their RVAs or general open data (e.g., Google Maps, Open Street Maps).

A previous study on municipalities, county administrative boards, and central authorities' work with critical dependencies (MSB, 2011, p. 16) suggested that actors on different levels do not seem to use specific criteria of what critical dependencies consist of. However, this thesis suggests that municipalities have a common picture of what critical dependencies are and that they are analyzing similar dependencies. Some municipalities stated during the interviews that the municipal activities may have another view on what dependencies are critical or perhaps what critical dependencies even consist of. At this point, it is assumed that municipalities that are supporting municipal activities in the analysis of critical dependencies use a national definition of critical dependencies. However, whether the exact same understanding of critical dependencies exists among municipal activities is not known. Therefore, the possibility to compare RVAs from all municipalities to create a national understanding of critical dependencies could be investigated further.

6.4 Information Management – Methods, Guidelines, and Follow-ups
MSB conducted an impact assessment in 2014, which concluded that it is considered important that municipal RVAs are of a "good quality", that they are consistent, and that they can be compared (Eriksson, 2016, p. 7). Hedtjärn Swaling and Ödlund (2021) investigated the feasibility of introducing common RVA methods, seeing that there today are no laws or regulations promoting one standardized method. They conclude that the analysis in itself could be viewed as more important than the presentation of the analysis (ibid., p. 2). However, the results of this thesis show that some municipalities already have had the chance to start developing their own ways of working and to support their municipal administrations and activities in their work with critical dependencies. Eriksson (2016, p. 47) concluded in her study of municipal RVA processes that many municipalities have been asking for clear instructions and methods to use. This is arguably still somewhat true for the result of this study. Nonetheless, just as Hedtjärn Swaling and Ödlund (2021) argued, the findings from this thesis point towards

a slight change of focus from considerations of methods to emphasizing the perceived added value of simply discussing the matter of critical dependencies with key stakeholders. However, the municipalities that imply that they do not have extensive and anchored work within their daily operations still seem to need help with the first steps towards conducting an RVA before they can go deeper into other aspects of the analysis. Furthermore, the findings highlight the importance of having a method that is firmly established within the municipal way of working to create good prerequisites for the analysis and to reduce dependency on specific individuals within the municipal functions. Thus, picking up on already integrated ways of working may be a future path for standardized methods for the analysis of critical dependencies in municipalities in Sweden.

Connected to the discussion about methods and guidelines is the discussion on "institutional memory" and the ability to pass on methods and knowledge connected to critical dependencies. However, it is important to put this into context. As explained in Chapter 3, the RVA process has not yet had too many cycles and it is, therefore, necessary to handle this claim with care. However, according to Hedtjärn Swaling and Ödlund (2021, p. 26) municipal preparedness coordinators stay in the same position within the same municipality for about 2-3 years. Since the RVA is made every fourth year, this should have a big impact on the institutional memory for the RVA process even though the analysis often lies at the level of the municipal activities. Since the preparedness coordinator has a responsibility for the analysis, a change of staff may affect the outcome of the RVA. Confusion may also arise within the municipal activities if some aspects of the RVA process and analysis of critical dependencies would be changed due to a new employee taking over the responsibility.

Moreover, continuous follow-ups and applied measures are essential for VSF and CI protection (MSB, 2014, p. 19). This is necessary not only for protection, but to allow for learning from events and disruptions, and to follow society's general development (ibid.). These follow-ups can be coincident with already existing processes, such as the yearly follow-up towards county administrative boards and the updating of the RVA every fourth year (see Chapter 3) (ibid.). Theme 7 in this study shows a split result in how municipalities are working with follow-ups. Even though the analysis is supposed to be revised and looked over once a year, with a bigger revision every fourth year, some municipalities seem to struggle with this. Most municipalities are revising the analysis every fourth year, but several municipalities state that they try to incorporate more frequent updates. Nevertheless, follow-ups once every fourth year may allow for learning even though it arguably may be easier to detect patterns of change if the follow-ups would be more frequent.

6.5 Limitations of the Study
6.5.1 Confidentiality
In the RVA it is up to the municipality to decide what type of information to publish (MSBFS 2015:5). Consequently, what type of information about CIs and interdependencies is available can vary from one RVA to another. However, detailed analyses of critical dependencies are considered to be classified information and are therefore not available to the public (MSB, n.d.-b). Concrete measures related to for example critical dependencies have also been classified in the studied RVAs for this thesis. This can be explained with that information on limiting

technical factors, such as lack of capacity and redundancy in critical systems, also should be classified in municipal RVAs (ibid.). Having access to detailed information about dependencies could arguably have been valuable for this study, specifically regarding RQ 1 to 3, since broader and more profound data could shed more light on the study's research aim of exploring how municipalities work with critical dependencies. Nevertheless, due to the above-explained restrictions regarding information related to critical dependencies, the interviewees were reminded to not share any confidential information both before and during the interviews. A confidentiality agreement containing information on data storage and use was also signed by all the interviewees to ensure an understanding of how the data would be handled and presented. The use of confidential data would affect the possibility of publishing this master's thesis. The RVAs used in the document studies were all publicly available and all data in the documents could be used for this study.

6.5.2 Contextual Factors

Another limitation of this study relates to the issue of contextual and current factors. For an inductive study like this, the descriptions and exploration of reality that have been provided are restricted to time and space and are inherently affected by the researcher's view on definitions and ways of measurement (Blaikie, 2010, p. 85). Moreover, this thesis is written in the spring of 2022, and it has become apparent during the study that the current situation in the world has affected how municipalities are seeing and working with critical dependencies. The Covid-19 pandemic has made its mark on municipalities' understanding of dependencies and many mentioned during the interviews that the municipality now has a different focus on preparedness and abilities to store materials for hospitals. During the interviews, it also became apparent that the war in Ukraine has shifted the municipal focus too, and many interviewees mentioned the concern of being able to provide and store fuel. Thus, it has to be taken into consideration that the discourse surrounding critical dependencies in Swedish municipalities is subject to change depending on recent events, and some municipalities may reflect upon their way of working with critical dependencies more before the RVA's for 2022 should be published. It should also be noted that due to the current war in Ukraine, studying and mapping national crisis preparedness was considered a sensitive topic. This was addressed together with the issue of confidential information in section 6.5.1, explaining that every interview started with a reminder that this study is not taking any type of classified information into account. The sensitive nature of the topic was also attended to through the careful anonymization of the studied municipalities and the interviewees. The anonymization arguably contributed to build trust and to gain access to information needed for this study.

6.5.3 Generalization

It is necessary to be careful when addressing this thesis's generalizability and to remember that this thesis only covers a sample of municipalities. Through the intrinsic case study, this thesis is not aiming to explore a general conception of how municipalities in Sweden work with critical dependencies within the RVA process but are rather focusing on the studied municipalities per se. However, due to the purposeful sampling of the municipalities included in this study the thesis tries to avoid to only study municipalities with certain preconditions. As seen in the results, management and analyses of critical dependencies can vary between municipalities depending on for example their access to resources and knowledgeable staff. Nevertheless, it is necessary to address the representation and non-representation of

municipalities across Sweden. As seen in Chapter 4, this study aimed to receive an even representation of municipalities across the country and of different sizes though this was not completely fulfilled. Most municipalities that declined to participate in the study did so because of too pressed schedules, indicating that smaller municipalities with fewer resources did not have the possibility to contribute to this study. Additionally, a couple of municipalities did not want to partake in the interview because of confidentiality reasons.

6.6 Suggestion for Further Studies

Due to the scope and time limit of a master's thesis a part of the risk governance framework on risk communication has deliberately not been addressed in this study. This part of the framework addresses the inclusion of civil society and communication with the civil society regarding risk-related issues. Instead, the thesis focuses on interaction and risk communication in between other actors. However, seeing the problem with confidential information and interdependency-related risks discussed in section 6.5.1, this topic could be of interest for further studies in this field. For example, not all municipalities have open access to their RVAs and most of the studied RVAs make a disclaimer about not all information about critical dependencies is available to the public. This is explained with that this type of information risks being used by illicit actors. A study on this could investigate how this affects municipalities' crisis preparedness and management, and whether the risks of not communicating everything to the public may overthrow the risk of the information being used wrongly.

7. Conclusion

The aim of this study is to explore how municipalities in Sweden work with the analysis of critical dependencies in the RVA process. The study is based on four research questions, which sprung from a framework of risk governance and risk management in relation to CI interdependencies and the notion of VSFs in Sweden. The research questions which supported the aim of this study are: What actors are the studied municipalities cooperating with in the identification of critical dependencies? In what ways is the institutional context affecting the studied municipalities' work with critical dependencies? What pre-defined methods are the studied municipalities working with to identify critical dependencies and what types of critical dependencies are identified? In what ways are the studied municipalities using the analysis of critical dependencies? A document study of 12 municipal RVAs, together with interviews with 16 municipalities across Sweden resulted in ten overarching findings which are summarized below.

In relation to the research questions, this thesis finds that most municipalities are trying to let the municipal activities have a large role in the mapping of critical dependencies. This allows the municipalities to pick up knowledge about possible critical dependencies only known by staff working with the municipalities' everyday activities. However, this study also shows that some municipalities have more resources and can support the municipal activities in their analysis of critical dependencies, whilst others lack the resources or knowledge to do this. Moreover, the results show that a lack of delimitations and clear boundaries surrounding the analysis of critical dependencies is a challenge for the municipalities. Due to the absence of a standardized method for municipalities to conduct an RVA and to analyze critical dependencies, this study sees that there are slightly different methods used across municipalities. Some municipalities use versions of state-provided methods, while other municipalities are still unsure of how to conduct an analysis. This gap may create difficulties for a compilation of municipal analyses of critical dependencies and to create an understanding of critical dependencies at a higher system level. Though, the study also finds that despite issues of complexity and different approaches used, most municipalities are analyzing similar critical dependencies such as electricity and IT-related dependencies.

Nevertheless, several municipalities ask for easier and more targeted guidance directed to the municipal activities to facilitate the analysis of critical dependencies. The municipalities in this study have some collaboration with other municipalities in the RVA process, but this study cannot say to what extent this is carried out. Furthermore, the municipalities are currently not inviting external actors into the RVA process due to for example confidentiality reasons. However, some municipalities express that they may be open for further collaboration with external actors in the future. For the use of the analysis, and the implementation of identified measures and follow-ups, the results of this study show that most municipalities are updating the analysis once every fourth year. However, a few municipalities are struggling with such updates and follow-ups, and this affects the municipalities' possibilities of learning from past events and to ensure future work and protection of municipal VSFs and CIs. A further challenge for the work is the lack of institutional memory due to staff turnover and the work being highly dependent on individuals.

To conclude, the findings of the study suggest that municipalities in Sweden are at different levels when it comes to the ability to manage and analyze critical dependencies. Some municipalities have established approaches and methods for the analysis of critical dependencies, while others are working towards finding suitable approaches. Even though there are challenges for the municipalities, the municipalities express a high perceived value for the municipalities to analyze critical dependencies.

However, this study finds that there arguably a need to develop methods that advances collaboration and can support municipalities' process with RVAs while avoiding the security and confidentiality issues currently challenging the analysis of critical dependencies. The complexity and lack of targeted guidelines for the analysis must also be addressed since it hinders a system-level analysis of critical dependencies. Important factors of municipal dependencies could be missed in the analysis since CIs and VSFs often are connected through networks, pipes, or rails that spans across society and the analysis rarely supersede municipal borders. Furthermore, opportunities allowing the municipalities to work with follow-ups and to apply identified and necessary measures are arguably of importance to further the quality and usefulness of the analysis of critical dependencies. Through these findings, this study is contributing to a further understanding of how Swedish municipalities are working with critical dependencies in the municipal RVA process. Furthermore, by examining how infrastructure dependencies can be managed within local governmental structures and how they can be mapped in RVAs, this thesis may contribute to advancing knowledge about opportunities, challenges, and current ideas related to critical dependencies. Potentially, this knowledge could also be transferred to other contexts and be used to optimize and streamline management of critical dependencies in a broader setting.

8. References

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Appendix A – Interview Guide, in Swedish

Namn på intervjuperson:
Titel:
Kommun:

Intervjun börjar
Intervjupersonen ges en kort beskrivning av projektet och syftet med intervjupersonens deltagande. Intervjupersonen blir tillfrågad om hen har några frågor kring det sekretessavtal som hen signerat innan intervjuns påbörjande. Intervjupersonen blir informerad att inspelningen av intervjun kommer att börja.

Inspelning börjar

Allmänna frågor
- Berätta kort om din roll inom kommunen.
  - Har du varit delaktig i arbetet med risk- och sårbarhetsanalyser inom kommunen?
  - Har du varit delaktig i arbete med kritiska beroenden inom kommunen?
- Hur beskrivs kritiska beroenden inom kommunen?
- Har synen på kritiska beroenden förändrats i och med Covid-19 eller kriget i Ukraina? Om ja, i sådana fall hur?

Aktörer
- Gör kommunen bedömningen av kritiska beroenden själv, i samverkan med andra aktörer, eller sker arbetet helt hos andra aktörer?
  - Vilka inom kommunen är delaktiga i arbetet?
  - Finns det några andra aktörer som är delaktiga i arbetet med kritiska beroenden? Om ja, vilka?
- Varför valdes den/de inblandade aktörerna att ansvara för genomförandet av analysen?
- Hur tas den/de analyser som görs till vara och hur kommer den in i kommunens arbete med kritiska beroenden i risk- och sårbarhetsanalysen?

Institutionell kontext
- Hur påverkar lagar och riktlinjer kommunens arbete med kritiska beroenden?
  - Vilka incitament har lagar och riktlinjer för arbetet med kritiska beroenden?
  - Vilka hinder utgör lagar och riktlinjer för arbetet med kritiska beroenden?
- Hur uppfattar kommunen uppdelningen mellan kommuners, länsstyrelsernas och nationella ansvarsområden när det kommer till kritiska beroenden?

Identifiering
- Användes någon specifik metod i arbetet för att studera de kritiska beroendena?
  - Hur valdes den metoden?
  - Har andra metoder för arbetet diskuterats?

- Finns det någon typ av information eller stöd, så som processer eller metoder, som saknas för att underlätta arbetet med kritiska beroenden i kommunen och i sådana fall vad?
- Vilka typer av beroenden fokuserar ni mest på?
- Vilka typer av hot och risker adresseras i relation till kritiska beroenden?

Hantering av information
- Den analys av kritiska beroenden som genomförs inför risk- och sårbarhetsanalysen, hur används den i kommunens arbete?
  - Finns det andra användningsområden för den kunskapen/analysen?
- Följs arbetet med kritiska beroenden upp? I sådana fall hur och hur ofta?
- I vilken mån tror du att kommunens arbete med kritiska beroenden bidrar till ökad beredskap för kommunen, regionen och nationellt?

Avslutande frågor
- Hur viktigt anser du att arbetet med kritiska beroenden är för kommunen?
- Finns det utmaningar i arbetet med kritiska beroenden som inte har nämnts under intervjun och vad för utmaningar är det i sådana fall?

Intervjun avslutas
Intervjupersonen meddelas att intervjun har kommit till sitt slut. Intervjupersonen tillfrågas om hen har några frågor eller något annat hen vill tillägga till intervjun innan intervjun avslutas. Intervjupersonen tackas för sitt deltagande och blir uppmärksammad på att hen kommer att få ta del av slutresultatet i form av publicerad masteruppsats. Intervjupersonen blir uppmärksammad på kontaktuppgifter till huvudförfattaren och att frågor kring projektet eller intervjupersonen deltagande välkomnas.

Inspelning avslutas

Appendix B – Interview Guide, in English

Name of the Interviewee:
Title:
Municipality:

Interview Starts
The interviewee is given a short introduction to the study and to the interviewee's role for the research. The interviewee is asked whether they have any questions regarding the confidentiality agreement which was signed by them before the start of the interview. The interviewee is informed that the recording of the interview will start.

Recording Starts

General Questions
- Please briefly describe your role within the municipality.
  - Have you been involved in the work with risk and vulnerability analyzes within the municipality?
  - Have you been involved in work with critical dependencies within the municipality?
- How are critical dependencies described within the municipality?
- Has the view of critical dependencies changed with Covid-19 or the war in Ukraine? If so, how?

Actors
- Does the municipality assess critical dependencies itself, in collaboration with other actors, or is the work completely conducted by other actors?
  - Who within the municipality is involved in the work?
  - Are there any other actors involved in the work with critical dependencies? If so, which ones?
- Why were the involved actor/actors chosen to be responsible for carrying out the analysis?
- How is the analysis used and how does it fit into the municipality's work with critical dependencies for the risk and vulnerability analysis?

Institutional Context
- How is the municipality's work with critical dependencies affected by laws and guidelines?
  - What incentives do laws and guidelines have for you to work with critical dependencies?
  - What hindrances for the work with critical dependencies may they have?
- How does the municipality perceive the division between the municipalities, county administrative boards, and national areas of responsibility when it comes to critical dependencies?

Identification

- Was any specific method used in the work to study critical dependencies?
    - How was the method chosen?
    - Have other methods of work been discussed?
- Is there any type of information or support, such as processes or methods, that is missing to facilitate the work with critical dependencies within the municipality? In such a case, what is missing?
- What types of dependencies are you focusing on the most?
- What types of threats and risks are addressed?

Information Management

- The analysis of critical dependencies that is carried out for the risk and vulnerability analysis, how is it used in the municipality's work?
    - Are there other uses for this knowledge/analysis?
- Is the work with critical dependencies followed up? In such a case, how and how often?
- To what extent do you think that the municipality's work with critical dependencies contributes to increased preparedness for the municipality, the region, and nationally?

Closing Questions

- How important do you think the work with critical dependencies is for the municipality?
- Are there challenges with the work on critical dependencies that have not been mentioned yet and what are those challenges in such cases?

Interview Ends

The interviewee is notified that the interview has come to an end. The interviewee is asked whether they have any questions or other remarks before the interview is formally ended. The interviewee is thanked for their participation and is informed that the end result in form of the published master's thesis will be shared with them. The interviewee is notified that contact and questions after the end of the interview are appreciated.

Recording Stops

Appendix C – Confidentiality Agreement Form for Interviews, in Swedish

Du har blivit tillfrågad att delta i en studie som genomförs inom ramen för ett masterarbete vid Lunds tekniska högskola under våren 2022. Detta samtyckesformulär beskriver projektet och villkoren för ditt deltagande.

Om studien

Sedan mitten av 00-talet har skydd av kritisk infrastruktur blivit mer uppmärksammat både inom EU och i Sverige. I det ingår att förstå hur infrastrukturer kan vara beroende av varandra för att fungera. I Sverige benämns detta som *kritiska beroenden* och är något som analyseras bland annat på kommunnivå. Tidigare studier av hur kritiska beroenden behandlas nationellt har bland annat pekat på brister i förståelsen av konceptet och det har saknats tydliga tillvägagångssätt för att arbeta med ämnet. Sedan dess har flertalet nya riktlinjer och stöd för arbetet tillkommit, men vissa aspekter av hur arbetet genomförs är fortfarande inte kända.

Målsättningen med studien är att öka förståelsen för hur kommuner i Sverige arbetar med kritiska beroenden idag. Studien utgår från ett riskhanterings- och styrningsperspektiv och fokuserar på kommuner som drivande aktörer i arbetet med kritiska beroenden. I arbetet använder jag mig av de risk- och sårbarhetsanalyser som varje kommun är skyldig att genomföra en gång per mandatperiod, men för att få en djupare förståelse ska arbetet nu kompletteras med intervjuer. Under intervjun kommer vi att behandla frågor som syftar till att undersöka hur information samlas in till analysen av kritiska beroenden, vilka aktörer som bidrar till analysen och hur arbetet med analysen används och implementeras i kommunens generella arbete.

Information om intervjutillfället
- Vid intervjun kommer jag att ta anteckningar och även spela in digitalt.
- Intervjun beräknas ta cirka 45 minuter.
- Ditt deltagande är frivilligt och du kan avböja att svara på en fråga du inte vill svara på eller prata om.
- Du är fri att avbryta ditt deltagande eller dra dig ur projektet när som helst och detta kommer inte resultera i några påföljder. All information som samlats in kommer då att förstöras om du inte vill att den skall användas.
- Du har också möjlighet att när som helst dra tillbaka delar av intervjun, eller annan typ av information som kommit studien till känna, när som helst.

Behandling av uppgifter

Jag säkerställer att all information som du delar med mig kommer att behandlas med största försiktighet.
- Informationen du tillhandahåller kommer att användas i forskningssyfte och kommer att presenteras och publiceras i enlighet med ett godkänt masterarbete vid Lunds tekniska högskola.
- All data kommer att analyseras på en aggregerad nivå, och presenteras i ett format som säkerhetsställer sekretess. Du kommer personligen inte identifieras i några resultat,

varken direkt eller indirekt. Du kommer heller inte bli citerad, varken i form av direkt citat eller genom omskrivning, ifall du inte specifikt har blivit tillfrågad om detta och du har fått möjlighet att verifiera kommentaren.

- All data, så som inspelning och transkription av intervjun, kommer att lagras i en elektronisk miljö vid Lunds tekniska högskola. Efter projektets slut kommer alla inspelningar och ljudupptagningar från intervjuerna att raderas. Anonymiserade transkriptioner av intervjun kan komma att sparas i upp till fem år efter projektets slut.

- De uppgifter som du tillhandahåller kommer endast att användas i mitt masterarbete och ingen originaldata (dvs icke anonymiserad) kommer att delas med tredje part.

- Du kan be om att all data som du tillhandahåller ska raderas när som helst under eller efter projektet, utan några som helst påföljder. För att göra detta, kontakta mig (se kontaktuppgifter nedan).

☒ Jag har blivit informerad om projektet och dess målsättningar genom detta formulär.

☒ Jag har förstått ändamålet med den kommande intervjun.

☒ Jag accepterar att min data kommer att användas i studien.

☒ Jag har läst och förstått den information som har delgetts mig i detta samtyckesformulär och jag accepterar att medverka i studien.

Signatur

Namn

Organisation och yrkestitel

Datum

Om du har några frågor, tveka inte att höra av dig till Aline Regnell via e-post xxx eller telefon xxx.

Appendix D – Confidentiality Agreement Form for Interviews, in English

You have been asked to participate in a study that is carried out as part of a master's thesis at Lund University of Technology in the spring of 2022. This consent form describes the project and the conditions for your participation.

About the Study

Since the mid-2000s, protection of critical infrastructure has received more attention both within the EU and in Sweden. To protect infrastructure, it is necessary to understand how infrastructures can depend on each other to operate. In Sweden, this is referred to as "critical dependencies" and is something that is analyzed, among other things, at the municipal level. Previous studies of how critical dependencies are treated nationally have, among other things, pointed to shortcomings in the understanding of the concept and there has been a lack of clear approaches to working with the subject. Since then, several new guidelines and support for the work have been added, but certain aspects of how the work is carried out are still not known.

The goal of the study is to increase the understanding of how municipalities in Sweden work with critical dependencies today. The study starts from a risk management and governance perspective and focuses on municipalities as driving actors in the work with critical dependencies. In my work, I make use of the risk and vulnerability analyzes that each municipality is obliged to carry out once every election period. But, in order to gain a deeper understanding the work will now be supplemented with interviews. During the interview, we will deal with questions that aim to investigate how information is collected for the analysis of critical dependencies, which actors contribute to the analysis and how the work with the analysis is used and implemented in the municipality's general work.

Information About the Interview
• At the interview I will take notes and also record digitally.
• The interview is expected to take approximately 45 minutes.
• Your participation is voluntary, and you can decline to answer a question you do not want to answer or talk about.
• You are free to cancel your participation or withdraw from the project at any time and this will not result in any penalties. All information collected will then be destroyed if you do not want it to be used.
• You also have the option of withdrawing parts of the interview, or other types of information that have come to the study's attention, at any time.

Processing of Data

I ensure that any information you share with me will be treated with utmost care.
• The information you provide will be used for research purposes and will be presented and published in accordance with an approved master's thesis at Lund University of Technology.
• All data will be analyzed on an aggregated level and presented in a format that ensures confidentiality. You will not be personally identified in any results, either directly or

indirectly. You will also not be quoted, either in the form of a direct quote or by paraphrasing if you have not been specifically asked about this and you have been given the opportunity to verify the comment.

• All data, such as recording and transcription of the interview, will be stored in an electronic environment at Lund University of Technology. After the end of the project, all recordings and audio recordings from the interviews will be deleted. Anonymized transcripts of the interview may be saved for up to five years after the end of the project.

• The data you provide will only be used in my master thesis and no original data (i.e. non-anonymized) will be shared with third parties.

• You can request that any data you provide be deleted at any time during or after the project, without any penalties whatsoever. To do this, contact me (see contact details below).

☒ I have been informed about the project and its objectives through this form.

☒ I have understood the purpose of the upcoming interview.

☒ I accept that my data will be used in the study.

☒ I have read and understood the information provided to me in this consent form and I agree to participate in the study.

Signature

Name

Organization and professional title

Date

If you have any questions, do not hesitate to contact Aline Regnell via e-mail xxx or phone xxx.