

Measuring community resilience in Swedish municipalities

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in Swedish municipalities**

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Abstract

All Swedish municipalities have planning tools such as a municipal action plan and a risk- and vulnerability assessment, which are governing documents on how to prepare, prevent and respond to accidents and crisis. However, there are no established methods for measuring community resilience in Sweden. Therefore, it could potentially be beneficial for Swedish municipalities to use a method for measuring community resilience. This paper analysed whether the concept resilience adds new perspectives to the work done with managing accidents and crisis, but also investigates whether the quantitative index method Baseline Resilience Indicators for Communities (BRIC) can be used for measuring community resilience in Swedish municipalities. The research questions were investigated with the help of a selection of literature. Moreover, a questionnaire and interviews were conducted to understand if the concept resilience adds new perspectives for managing accidents and crises, and also if the BRIC method could provide relevant information for professionals working with accidents and crisis.

The results in this thesis indicate that the BRIC method, and more specifically the included indicators could potentially complement the work done for managing accidents and crisis. However, the thesis could not determine with certainty whether the BRIC method would facilitate the work done with managing occurred events. Finally, the results in this thesis also indicate that the concept resilience does add new perspectives for managing accidents and crises in Sweden. However, there were some ambiguity in how the concepts adds new perspectives.

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Summary

In Sweden, municipalities are responsible for managing the physical planning as well as many public welfare services. Municipalities also play an important role in managing accidents and crises because of the proximity and responsibility principle (Månsson, 2018, p. 37). There are several laws, such as LSO and LEH, as well as governing documents such as municipal action plans and Risk and Vulnerability Assessments (RVA) that regulate how accidents and crises should be managed within the municipality. However, there are no established way to measure the community resilience in Sweden. With regards to the connections between physical planning, geographical conditions and community resilience (Cutter, et al., 2014, p. 2), it could be beneficial for Swedish municipalities to measure the community resilience.

This thesis aimed to investigate whether the concept resilience adds new perspective to prevention, preparedness and response planning for accidents and crises in Sweden. Furthermore, it investigated if the quantitative index method Baseline Resilience Indicators for Communities (BRIC) for measuring community resilience could provide relevant information for municipalities' work with managing accidents and crises, and if there is a need for adapting the method for the Swedish context. The research questions were studied with the help of a selection of literature relevant for the subject. Also, a questionnaire was sent out to professionals' working with accidents and crises in municipalities in Skåne and complementary interviews were conducted for a deeper understanding of some responses from the questionnaire. One part of this thesis was to limit and adapt the original indicators to fit the Swedish context, but also to limit the number of indicators that were included in the questionnaire. The screening process of indicators was done with the help of the selection of literature and facts about the Swedish context.

The results from this thesis indicate that the BRIC method could potentially complement the work done with accidents and crises. However, the original indicators in the method should be adapted for the Swedish context, mainly because there are no set of indicators that fit all contexts (Scherzer, et al., p. 3). Moreover, most of the included indicators received a high response rate in the questionnaire. Nevertheless, a complete set of indicators that are suitable for the Swedish context is not presented in this thesis because there needs to be further research on the subject.

Finally, the results from this thesis also indicate that the concept resilience does add some new perspectives to prevention, preparedness and response planning for accidents and crises in Sweden. However, there were some ambiguity in how the concepts adds new perspectives.

Sammanfattning

I Sverige ansvarar kommunerna för den fysiska planeringen samt för flertalet av de offentliga välfärdstjänsterna. Kommunerna har även en viktig roll i hantering av olyckor och kriser på grund av närhets- och ansvarsprincipen (Månsson, 2018, s.37). Det finns flera lagar, såsom LSO och LEH, samt styrdokument som kommunala handlingsplaner och Risk och Sårbarhetsanalyser (RSA) som reglerar hur olyckor och kriser ska hanteras inom kommunen. Dock finns det inget etablerat sätt att mäta samhälllig resiliens i Sverige. Enligt Cutter, et al. (2014, s. 2) finns det samband mellan den fysiska planeringen, geografiska förhållanden och samhälllig resiliens. Det finns därför potentiellt en fördel för svenska kommuner att mäta resiliens inom deras geografiska område.

Denna uppsats syftar till att undersöka om begreppet resiliens tillför nytt perspektiv till beredskaps- och insatsplanering inför olyckor och kriser i Sverige. Vidare undersöks även om den kvantitativa indexmetoden Baseline Resilience Indicators for Communities (BRIC) för att mäta samhälllig resiliens kan bidra med användbar och betydande information för kommunernas arbete med att hantera olyckor och kriser, samt om det fanns ett behov av att anpassa metoden för svensk kontext. Forskningsfrågorna studerades med hjälp av ett urval av litteratur som är relevant för ämnet och den svenska kontexten. Dessutom skickades en enkät till yrkesverksamma som arbetar med olyckor och kriser i samtliga kommuner i Skåne och kompletterande intervjuer genomfördes för en djupare förståelse av vissa svar från enkätundersökningen. En del i arbetet var att begränsa och anpassa de ursprungliga indikatorerna i BRIC för att passa den svenska kontexten, men begränsningen gjordes även för att minska antalet indikatorer som inkluderades i enkätundersökningen. Begränsning och anpassning av indikatorer gjordes med hjälp av relevant litteratur och fakta om den svenska kontexten.

Resultaten från detta arbete tyder på att BRIC-metoden potentiellt kan komplettera arbetet med beredskaps- och insatsplanering inför olyckor och kriser. De ursprungliga indikatorerna i BRIC bör dock anpassas för det svenska samhället, främst för att det inte finns någon uppsättning indikatorer som passar alla kontexter (Scherzer, et al., s. 3). Vidare fick de flesta av de inkluderade indikatorerna en hög svarsfrekvens i enkätundersökningen. Dock presenteras inte en fullständig uppsättning indikatorer som passar i den svenska kontexten i detta arbete eftersom det krävs vidare forskning inom ämnet.

Slutligen visar resultaten från detta arbete också att begreppet resiliens bidrar med nya perspektiv för beredskaps- och insatsplanering inför olyckor och kriser i Sverige. Däremot fanns en viss tvetydighet i hur begreppet bidrar med nya perspektiv.

Table of contents

List of Abbreviations.....	1
1. Introduction.....	2
1.1. Purpose	3
1.2. Problem formulation.....	4
1.3. Limitations	4
2. Background and related research.....	5
2.1. Resilience and vulnerability	5
2.2. Different assessment approaches.....	6
2.3. Baseline Resilience Indicators for Communities (BRIC)	6
2.4. Swedish context.....	9
3. Method overview	11
3.1. Choice of literature.....	11
3.2. Screening indicators	12
3.3. Questionnaire and interviews.....	12
4. Indicators.....	14
4.1. Included indicators.....	14
4.2. Excluded indicators.....	22
5. Questionnaire and interviews.....	30
5.1. Questionnaire	30
5.2. Interviews.....	30
6. Questionnaire and interview responses.....	32
6.1. The respondents'	32
6.2. Community resilience.....	33

6.3.	The BRIC method.....	35
7.	Discussion.....	42
7.1.	BRIC and the indicators	42
7.2.	Community resilience.....	45
7.3.	Limitations	46
7.4.	Future studies	47
8.	Conclusions	48
	References	49
	Appendix 1 – The original BRIC	i
	Appendix 2 – Questionnaire.....	iv
	Appendix 3 – Results from questionnaire	xiii
	Appendix 4 – Interviews	xxix

List of Abbreviations

BRIC	Baseline Resilience Indicators for Communities
DRM	Disaster Risk Management
FRG	Disaster volunteer resource group Frivilliga resursgruppen
LEH	Act (2006: 544) on municipalities and county councils' measures before and in the event of extraordinary events and heightened preparedness Lag (2006:544) om kommuners och landstings åtgärder inför och vid extraordinära händelser och höjd beredskap
LSO	Act (2003:778) on protection against accidents Lag (2003:778) om Skydd mot Olyckor
MSB	Swedish Contingency agency Myndigheten för Samhällsskydd och Beredskap
PTS	Post and Telecom authorities Post- och Telestyrelsen
RVA	Risk and Vulnerability assessment
SCB	Statistics Sweden Statistiska centralbyrån
SFI	Swedish for immigrants Svenska för invandrare
SoVI	Social Vulnerability Index

1. Introduction

The Sendai Framework for Disaster Risk Reduction is a globally accepted agreement to strengthen economic and social resilience (UNISDR, 2015). The goals of the framework are to reduce and prevent severe impacts from events due to climatic changes, man-made events and other natural hazards by enhancing resilience (Ibid.). Resilience is defined as the societies ability to respond and recover from impacts and also adapt by re-organizing, changing and learning from past events to better manage future events (Cutter, et al. 2008, p. 599). Resilience can have several other definitions and meanings in other contexts (Bergström, 2018, p. 33). In this thesis resilience and community resilience have the same definition. Furthermore, the application of the concept has during the past years had an upswing of popularity within the field of Disaster Risk Management (DRM)(IFRC, 2016).

This thesis examines how resilience can be measured and applied within the Swedish DRM system. In the context of the Swedish DRM system this encompasses all levels of society, both the private and public sector, as well as all levels of government, such as national, regional and municipal government agencies (Månsson, 2018, p. 37). One part of the DRM system is that all municipalities, county councils, county administrative and national authorities are legally obliged to carry out a Risk and Vulnerability Assessment (RVA) (Ibid., p. 39). The conducted RVA aims to identify the risks and vulnerabilities that exists within organisations on different levels of society (MSB, 2011a, p. 15). Furthermore, the analysis also contributes to the implementation of risk reduction measures, disasters preparedness plans and increases the knowledge and awareness to both decision-makers and the public (Månsson, 2018, p. 39). All conducted RVAs are then compiled by the Swedish Civil Contingencies Agency (MSB¹) and provides an overview of the risks and vulnerabilities that exists nationally (Ibid.).

Municipalities play an important role in the Swedish DRM system due to the proximity and responsibility principles (Månsson, 2018, p. 37). These principles mean that the stakeholders who are responsible for a geographical area and holds a function in everyday practices, also are responsible for maintaining the disrupted function in that geographical area when accidents and crises occurs (Ibid.). Accidents and crises are often limited to a geographical area, i.e., a county or a municipality, and also managed by stakeholders within that geographical area (Ibid.).

In counties and municipalities there are different laws that regulate the work of preventing, preparing and responding to accidents and crises. Examples of these laws are Act (2003:778) LSO²

¹ Myndigheten för Samhällsskydd och Beredskap, MSB

² Lag (2003:778) om Skydd mot Olyckor

and Act (2006:544) LEH³. LSO regulates prevention, preparedness and response measures for accidents that can harm human life and health as well as property and environment (MSB, 2011b, p. 13). LEH regulates how municipalities and counties prevent, prepare and respond to crises that are defined as extraordinary events⁴, both in peace time as well as in heightened state of alert (Eriksson & Johan, 2020).

Cutter, et al (2010, p. 2) argue that there are connections between the physical planning, the geographical conditions and the community resilience, which is also reflected in the Sendai Framework for Disaster Risk Reduction (UNISDR, 2015). A group of people in a geographical location counts as a community (Amundsen, 2012, p. 1). The lowest level in Sweden that is analysed in the conducted RVA's is the municipal level, where both the physical planning and geographical conditions of the municipality are included (MSB, 2011a, pp. 29-31). Even though some aspects of the DRM system rely on the ability and capacities of the residents in the community, there are no established systems to measure the resilience or the vulnerability on a sub-municipal level in Sweden. Moreover, the resources within municipalities and counties could potentially be distributed more efficiently to the parts of the community that has the greatest need of implemented measures if there was a way to measure community resilience (Cutter, et al., 2010, p. 2).

There are several methods for measuring community resilience (Chuang, et al., 2018, p. 355). Cutter, et al. (2014) developed a place-based, top-down, quantitative index method called Baseline Resilience Indicators for Communities (BRIC). The method measures different aspects of community resilience with statistically measurable indicators (Ibid.) BRIC is one of the more extensive and well-cited approaches for measuring community resilience (Copeland, et al., 2020, p. 2). Also, the model has recently been applied to a national risk index for USA, which is a standardised index that measures the social vulnerability and community resilience to different hazards across the country (FEMA, n.d.). Furthermore, BRIC provides simple results for decision-makers, builds on existing statistics and does therefore not require an extensive data collection.

1.1. Purpose

This thesis aims to investigate whether there are benefits of measuring community resilience on a sub-municipal level in Sweden, and also whether the BRIC method for measuring community resilience could be adapted for the Swedish context. By measuring community resilience on a sub-

³ Lag (2006:544) om kommuners och regioners åtgärder inför och vid extraordinära händelser och höjd beredskap

⁴ An event that deviates from the normal, entail a serious disturbance or imminent risk of a serious disturbance of important societal functions and requires urgent action by a municipality or a region.

municipal level, the limited resources within the community could be allocated efficiently to the parts of the community that has the greatest need of enhanced resilience.

1.2. Problem formulation

To achieve the purpose of this thesis, the following questions will be analysed:

- What information about community resilience can facilitate the prevention, preparedness and response planning for accidents (LSO) and crises (LEH) in Sweden?
- Can the application of BRIC provide relevant information for municipalities' work with preventing and preparing for accidents and crises, respectively and are there needs to adapt the method to this context?

The first question aims to examine whether community resilience can contribute with new perspectives that facilitate the work with prevention, preparedness and response planning for accidents (LSO) and crises (LEH). The second question evaluates whether the BRIC method and the indicators fit the Swedish context, and also if there are missing indicators in BRIC that could be relevant in Sweden. Furthermore, the question aims to examine if these indicators provide valuable information about the residents and therefore facilitate prevention, preparedness and response planning for accidents and crisis in the municipality.

1.3. Limitations

Community resilience is a vast subject and there are several different approaches for measuring community resilience. Due to limitations in time, some demarcations have been drawn to narrow the scope of this thesis.

This thesis will solely focus on the BRIC method for measuring community resilience. Other approaches will be mentioned briefly. Furthermore, the BRIC method is in this thesis adapted for the Swedish context and the 23 included indicators are limited, adapted and changed with the help of the original 49 indicators. The limitation and adaptation of indicators is in itself a limitation, because the selection of indicators is dependent on the choice of literature and there was not sufficient time to include all literature that could potentially be relevant. Furthermore, an analysis of the statistical correlations between indicators could facilitate the selection of indicators. However, no statistical analysis has been done in this thesis. Finally, this thesis will not include an empirical validation of the indicators due to the difficulty to empirically validate quantitative methods.

2. Background and related research

A national risk index was launched in USA during the fall of 2020, and is a combination of social vulnerabilities and community resilience with regards to the existing hazards as well as the built environment (FEMA, n.d.). The purpose of having a national risk index is to get an overview of where the resources for decreasing the risks in the country are needed the most (Ibid.). Cutter, et al. (2003; 2014) developed both the social vulnerability index (SoVI) and the community resilience index (BRIC) that FEMA uses in the national risk index for measuring social vulnerability and community resilience.

Wagner (2018) has previously analysed social vulnerability indexes and how such an index could be adapted for the Swedish context. Therefore, this thesis will not analyse social vulnerability index. However, there are both similarities and differences between social vulnerability and community resilience, which are discussed further in subsection 2.1. This section also discusses approaches for measuring community resilience, the BRIC method and the Swedish DRM system.

2.1. Resilience and vulnerability

Resilience has over the past years replaced concepts such as vulnerability and sustainability in development planning (Weichselgartner & Kelman, 2014, p. 249). Some factors that may contribute to the increased popularity of the concept is the holistic perspective and flexibility that resilience entails (Ibid.). Furthermore, both resilience and vulnerability are concepts with ambiguous definitions and there is no clear consensus among different literature on an exact definition or an exact difference between the concepts (Alexander, 2013, p. 2707; Cutter, et al., 2003, p. 242). Some authors argue that the two concepts are opposites, while others argue that there are some significant differences (Cutter, et al., 2008, p. 600; Weichselgartner & Kelman, 2014, p. 252).

This thesis adopts Cutter, et al. (2008) definitions of both resilience and vulnerability because both methods, SoVI and BRIC, are developed by Cutter and colleagues. According to Cutter, et al. (2008, pp. 599-600), vulnerability is the inherent conditions and qualities of a social system that potentially can be harmful when an event occurs (Ibid.). Resilience, on the other hand, includes all the beforementioned inherent conditions, but also regards the system's ability to respond and recover from impacts and also adapt by re-organizing, changing and learning from past events to better manage future events (Ibid.). Thus, the main difference is that the resilience concept entails learning from past events, enabling better anticipation and adaptation capacity for future events (Weichselgartner & Kelman, 2014, p. 252).

Some other differences between vulnerability and resilience can be found in frameworks for modelling the two concepts. Cutter, et al. (2003, pp. 246-247) includes different categories that contribute to vulnerability, some of which are social, economic, institutional and infrastructural. In later research, when developing the framework for resilience (BRIC) the six factors that contribute to resilience are social, economic, institutional, infrastructural, community and environmental (Cutter, et al., 2014, p. 68). When looking closer at the frameworks, a clear difference between vulnerability and resilience is that resilience includes environmental factors that can potentially affect the community.

2.2. Different assessment approaches

Measuring resilience is a difficult task, but there are different approaches that aim to measure attributes of resilience (Copeland, et al., 2020, p. 1). Some types of approaches for measuring community resilience are participatory, qualitative and quantitative methods (IFRC, 2016). Participatory approaches are better suited for smaller communities, because these approaches rely on the participation of key actors within the community (IFRC, 2007). These methods also depend on the knowledge and risk perception that the key actors have (Scherzer, et al., 2019, p. 3). Furthermore, there are several types of qualitative approaches, some of which include interviews and observations of a community (Ibid.). The main feature in a qualitative approach is that the indicators used to measure resilience are not exact measures, i.e., not statistically measurable (Cimellaro, 2016, p. 61). An example of a qualitative indicator is a community's risk awareness (Ibid.). Finally, quantitative approaches are methods that use measurable indicators, e.g., unemployment rate, voter participation, etc. (Scherzer, et al., 2019, p. 3).

Much similar to the definition of resilience, the approaches for measuring resilience are diverse and aim to measure different aspects of resilience (ecological, engineering, etc.) (Saja, et al., 2019, p. 3). The choice of method depends on how resilience is defined, and if the framework is hazard specific or adapted to a specific geographical context (Ibid.).

2.3. Baseline Resilience Indicators for Communities (BRIC)

This thesis will focus on the quantitative and place-specific index method BRIC for measuring community resilience (Cutter, et al., 2014, p. 68). The main reasons for analysing BRIC are because the method is one of the more extensive and well-cited approaches (Copeland, et al., 2020, p. 2). Furthermore, other methods measure resilience for a specific hazard whereas BRIC is a multi-hazard approach (Saja, et al., 2019, p. 5). As previously mentioned in section 2.1., there are six different sub-domains, i.e., categories of community resilience in the BRIC method. Within the sub-domains there are 49 indicators that reflects different aspects of community resilience (Ibid.).

All indicators are measurable variables that in the BRIC method are normalised to a number between 0 and 1, where 0 reflects a low resilience score for that indicator in a specific geographical area and 1 reflects a high resilience score (Ibid.). The normalisation ensures that all indicators can be added together to form a resilience score within each sub-domain (Scherzer, et al., 2019, p. 4 – 5).

$$SUB = \frac{1}{N} \sum_{i=1}^N x_i \quad \text{Equation 1}$$

The indicators within each sub-domain are summarised according to Equation 1, where N is number of indicators within the sub-domain and x_i is the score of the indicator within a geographical area (Scherzer, et al., 2019, p. 5). By dividing the total score in each sub-domain with the number of indicators within the category, the received SUB score is between 0 (low resilience) and 1 (high resilience) within a certain geographical area.

$$BRIC = SUB_{soc} + SUB_{econ} + SUB_{com} + SUB_{inst} + SUB_{infra} + SUB_{envi} \quad \text{Equation 2}$$

Finally, to form an overall community resilience score for a certain geographical area, the values from each sub-domain are added together according to Equation 2 (Scherzer, et al., 2019, p. 5). All indicators and categories are weighted equally in the computing of the score for both the sub-domains and the overall community resilience score (Cutter, et al., 2014, p. 67 – 68).

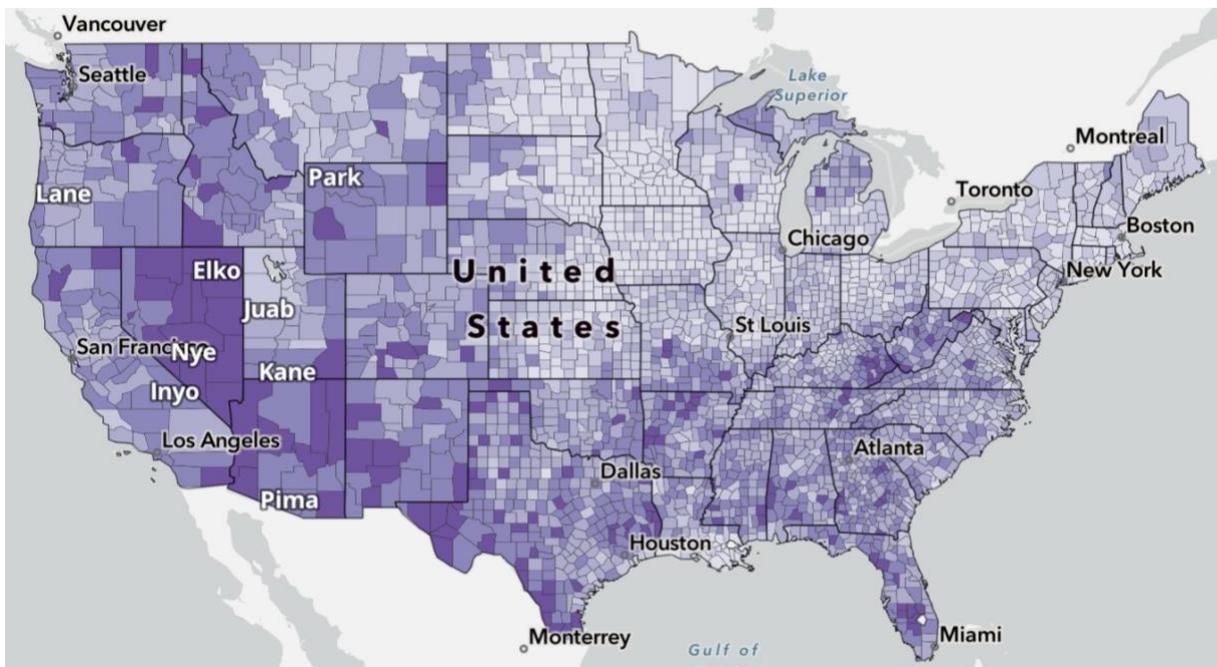


Figure 1. The visualization of the overall score for community resilience, reprinted from National Risk Index (NRI) (2020).

Retrieved October 27, 2020, from <https://nationalriskindex-test.fema.gov>. Reprinted with permission.

Cutter, et al. (2014, p. 71) applied the BRIC method for all communities across USA and produced a map with different colours depending on the overall resilience score in each community, presented in Figure 1. Light purple/white represents high resilience scores, dark purple represents a low resilience score in the chosen geographical area. A map similar to the one shown in Figure 1 can also be done for the resilience score in each sub-domain (SUB) and in that way provide a more detailed understanding of what aspects that contribute to higher or lower community resilience score (Ibid.).

2.3.1. Benefits and disadvantages with BRIC

Some benefits with BRIC are that the method can be applied on a sub-municipal, municipal, county and national scale (Cutter, et al., 2010, p. 17). As long as there are available data on the chosen geographical area, BRIC can be used to compute the community resilience within the chosen area. Also, the results from the model are of a visual nature and therefore easy for decision-makers to understand, which could contribute to simplifying the work with how to distribute limited resources (Ibid.).

The application of the model is simple and easy to use when the chosen indicators are based on available data (Scherzer, et al., 2019, p. 11). BRIC is a model that is developed and applied in USA (Cutter, et al., 2014), but has also been adapted and applied in a study in Norway (Scherzer, et al., 2019). Scherzer et al. (2019) adopted some of the indicators from BRIC but has also adapted others to fit the Norwegian context. While the model is easy to compute and understand, the process of adapting and selecting indicators to fit the local context is more complicated (Scherzer, et al., 2019, p.3). The selection of indicators is subjective and will most likely differ depending on the knowledge and experience of the person doing the selection (Burton, 2015, p. 74; Copeland, et al., 2020, p. 2). Also, indicators that are relevant for measuring resilience in one place could be irrelevant for measuring resilience in a different context (Copeland, et al., 2020, p. 2).

The normalisation of indicators is another disadvantage with BRIC (Cutter, et al., 2014, p. 68). Each indicator is given a value through the normalisation process that represents a high or low resilience score, which implies some kind of ideal state of resilience (Copeland, et al., 2020, p. 7). Indicators are used as proxies to measure aspects of resilience (Cimellaro, 2016, p. 62), and are thus used to simplify and quantify complex realities (Cox & Hamlen, 2015, p. 222) This simplification process might leave out nuances and important information. Additionally, there can be difficulties with analysing the validity of the indicators, i.e., if the indicators do actually have an impact on the community resilience (Cariolet, et al., 2019, p. 11).

Some other disadvantages are that the final resilience score is a relative value, which means that it can only be compared with other resilience values that uses the exact set of indicators as well as the same normalisation and computing process (Cutter, et al., 2014, p. 68). Furthermore, any interrelationships and connections between the indicators are disregarded in BRIC (Chuang, et al., 2018, p. 355) and only the statistical correlations between the variables are analysed (Scherzer, et al., 2019, p.4). There are also difficulties with measuring the interconnections between characteristics of the community and the severity of consequences from different events (Copeland, et al., 2020, p. 1). Finally, aspects such as cooperation, coordination and relations between different organisation and municipalities that are often important in a crisis are disregarded in BRIC (Scherzer, et al., 2019, p. 3).

2.4. Swedish context

As previously mentioned, the lowest analysed levels in the Swedish DRM system are the municipal levels. Furthermore, there are presently no established methods to analyse the community resilience in Sweden. The Swedish DRM system could benefit from using a method such as BRIC, even though there are significant differences between the contexts in Sweden and USA. This way, the method can potentially facilitate the work with preventing and preparing for accidents and crisis on a municipal level.

Amundsen (2012, p. 4) discusses the important roles that Norwegian municipalities have in achieving goals set up by the government due to the responsibilities they have with being the local providers of public welfare services, such as schools, childcare, etc. Similar to Norway, Swedish municipalities also have great responsibility for the physical planning as well as public welfare services, which for instance include the emergency rescue services⁵. Municipal authorities are, due to the proximity and responsibility principle, often the key stakeholders when managing accidents and crises (Månsson, 2018, p. 37).

2.4.1. Swedish legislation

The prevention, preparedness and response planning for accidents and crises are mainly regulated through the two laws LSO (2003:789) (accidents) and LEH (2006:554) (events that are classified as extraordinary events, i.e., crises). These legislations enable the work with accidents and crises within each municipality to be adapted to the risk profile that is relevant in that certain geographical area (MSB, 2011a, p. 29; MSB, 2011b, p. 15).

⁵ Kommunal räddningstjänst

According to 3 Chapter § 3 LSO (2003:789), all municipalities have to conduct an action plan⁶. These action plans should include the preventive measures within the municipality as well as how these measures are implemented (MSB, 2011b, pp. 18-19). The municipal action plan should also include the risks that exist in the municipality that could potentially lead to a rescue operation and analyse to what capacity the municipal emergency rescue service is able to carry out rescue operations (Ibid., p. 21).

All municipalities are also obligated to conduct a municipal RVA according to 2 Chapter 1 § LEH (2006:554). The RVA aims to analyse extraordinary events that could occur and the potential impact of these events (MSB, 2011a, p. 29). This analysis is conducted through identifying and estimating risks, vulnerabilities and critical dependencies within the municipality (Ibid., p. 20). The RVA is aimed at facilitating the coordination of planning and preparing for crises (Ibid.).

Both the municipal action plan and the RVA are planning tools for the municipality and the municipalities could potentially benefit from a greater knowledge about community resilience.

⁶ Kommunala handlingsprogram

3. Method overview

The method is divided into three different parts in order to answer the problem formulation in this thesis. A literature review was conducted to allow for the adaptation of the BRIC indicators to fit the Swedish context and to reduce the number of indicators. The literature review also facilitated the establishing of the questionnaire. Moreover, the questionnaire was conducted to get an idea of what professionals within the field of prevention, preparedness and response planning for accidents and crises thought about community resilience and the BRIC method. In general, questionnaires facilitate the collection of information from a larger group of people, which is the main reason for using this data collection method. Finally, a few shorter complementary interviews were conducted, using questions that were based on the answers collected in the questionnaire.

3.1. Choice of literature

The choice of literature in this thesis was focused on Cutter, et al.'s (2014) paper about BRIC. To build an understanding about the BRIC method, a selection of background literature about the Social Vulnerability Index (SoVI) and resilience was chosen. The main background information about SoVI was collected through the previous work conducted by Cutter, et al. (2003; 2008; 2010), but also by reading the thesis by Wagner (2018) about SoVI. Most of the other literature was found by reading articles that Cutter, et al. (2014) referenced to, as well as searching for documents that had referenced to Cutter, et al. (2014).

There were 278 documents that had referenced to Cutter, et al. (2014), and from those, 37 documents were selected for further reading. Scopus was used to find these documents and all source types could be found among the 278 documents. Of the 37 documents, 36 were academic articles and 1 was a book chapter. The selection of the 37 documents was made by reading abstracts and choosing the articles that followed one or several of the criteria listed below.

- Articles that studied community resilience in an EU country were selected.
- Articles that clearly stated in the abstract how indicators can be chosen were selected.
- Articles that clearly mentioned BRIC were selected.
- Articles that clearly focused on other methods than BRIC were not selected.

Most EU countries have similar regulations and risk profiles, which is the reason for limiting to articles that studies community resilience within this region. The other three criteria were applied to better understand BRIC and the indicators, and to limit the selection among the 278 documents.

Scherzer, et al. (2019) was an article that referred to Cutter, et al. (2014), which was a study on the application of BRIC in a Norwegian context. Some of the literature chosen for this thesis was

found through analysing how Scherzer, et al. (2019) had chosen the indicators included in their application of BRIC. This selection of literature was done with regard to the similarities between Norway and Sweden.

3.2. Screening indicators

The next step was to choose relevant literature to enable the screening of indicators. From the 37 articles chosen for further reading, 11 were relevant for the screening of indicators. The criteria listed in subsection 3.1 were also regarded when reading the 37 articles chosen from the first screening.

These 11 articles formed the basis for choosing indicators together with sources about the Swedish context and the legislations LSO and LEH. Facts about the Swedish context were retrieved by searching for statistics and information on the webpage of various authorities such as Statistics Sweden (SCB⁷), MSB, etc.

Screening of indicators was partly done to limit the number of included indicators in the questionnaire, but also to exclude indicators with less relevance for Sweden. The following list presents the criteria used to screen indicators.

- Indicators criticised for a context that resembles the Swedish are excluded.
- Indicators with relevance for the Swedish context are included.
- Indicators that resemble each other are either merged into one indicator or only one of them are included.

All indicators have been assessed based on both the positive aspects and the critique found in the selection of literature, and the screening process is therefore a joint assessment of all relevant facts for each indicator. In section 4, the process of selecting indicators is presented.

3.3. Questionnaire and interviews

Petty's (2014) general method on how to design a questionnaire were used as a basis when designing the questionnaire in this thesis, which was done by following the steps. A detailed overview of the questionnaire design is found in section 5.

1. Specify the purpose of the questionnaire and which questions the questionnaire should answer.
The first step is very dependent on the target group and what questions in the study that needs to be answered.

⁷ Statistiska Centralbyrån, SCB

2. Decide how the questionnaire should be conducted. Questionnaires can be distributed in many different forms depending on the range of the work. In this thesis the questionnaire was conducted through the program Survey Monkey⁸, used to facilitate the work and subsequent analysis of the survey.
3. Write the questions in the questionnaire.
4. Proofread the questions and go through the questionnaire to estimate the time to do the questionnaire.
5. Do a test round of the questionnaire. This final step of forming the questionnaire was done to gain an understanding of how the questionnaire could be interpreted and if the questions were unclear or incomprehensible.

Due to the important role municipalities have in managing accidents and crises, professionals working with prevention, preparedness and response planning for accidents (LSO) and crisis (LEH) in municipalities were chosen as respondents for the questionnaire. In most municipalities in Sweden, the emergency rescue services work with accidents and other municipal administrations work with crisis management. However, in some smaller municipalities the emergency rescue services are responsible for both managing accidents and crises.

Contact information for the professionals working in 33 municipalities of Skåne were retrieved by contacting all municipalities. The main reasons for choosing the municipalities in Skåne were because of the variety of the population size in the municipalities and the variety in the risk profile among the chosen municipalities. Also, the geographical closeness to these municipalities facilitated the collection of contact details due to the connections between the university and the municipalities. The questionnaire was distributed through the program Survey Monkey and was sent out a total of 52 people working in the different municipalities in Skåne.

The interviews that followed the questionnaire were based on the respondents' answers. These interviews aimed at better understanding the answers given by the respondents, where two interviews were conducted to get a deeper understanding about the responses while others aimed at understanding the reason for not responding to the whole questionnaire. A detailed overview of the interviews is found in section 5.

⁸ <https://www.surveymonkey.com/>

4. Indicators

This section presents the indicators that were included in and excluded from the questionnaire. The selection of indicators was based on the original BRIC model but have been adapted and changed with the help of the selection of literature and facts about the Swedish context. A full list of all original indicators and how they are measured are presented in Appendix 1 – The original BRIC.

All indicators are analysed based on their relevance for the Swedish context and the work with the legislations LSO and LEH. In total, 23 indicators are included in the questionnaire, some of which were adapted and/or changed to fit the Swedish context. However, excluded indicators are not necessarily irrelevant for measuring resilience or the Swedish context, but due to limitations in this thesis some kind of prioritisation had to be done.

4.1. Included indicators

All the included indicators are analysed and discussed in this sub-section. The included indicators are presented in Table 1, and each indicator is further discussed below the category to which it belongs.

Table 1. The 23 indicators that were included in the questionnaire.

Subdomain	Aspect	Indicator
Social resilience	Educational attainment	Percent of population with at least a high school diploma
	Income level	Percentage of population with average or higher income level
	Working age	Percent of population between ages 15 – 67
	Swedish language competency	Percent of population that has been enrolled on the SFI course during the past 5 years
	Non-special needs	Percent of population that are not dependent on special assistance (elderly care, personal assistance)
	Health services	Number of medical care staff per capita
Economic resilience	Employment rate	Percentage of the population employed

	Income equality	Gini-coefficient
	Single sector business	Number of employments in same industry per capita
	Public tax-financed employment	Number public tax-financed employments per capita
Community capital	Political engagement	Percent of population that votes in the general election
	Community involvement	Percent of population involved in various leisure activities (religious, sport, cultural)
	Social capital - disaster volunteerism	Percent of population that are active in FRG
Institutional resilience	Mitigation spending	Average amount spent per capita on mitigation and preparedness measures (SEK)
	Disaster experience	Number of events that the municipality have applied for state compensation according 7 Chapter 3§ LSO (2003:778) and/or 5 Chapter 1§ LEH (2006:544)
	Closeness to emergency service	Mean distance to emergency services (police, fire rescue service, ambulance)
	Population stability	Absolute in/out migration as percentage of population
Infrastructure/ Housing	Temporary shelter availability	Number of hotel/motels per capita
	School restoration potential	Number of schools per capita

	Industrial re-supply potential	Mean capacity of train stations, airports, ports, major roads
	Communication capacity	Percent of population with a smartphone
Environmental resilience	Natural flood buffer	Area wetland
	Pervious surfaces	Area permeable land

4.1.1. Social resilience

The social resilience category aims to capture demographic attributes in the community that would contribute to resilience (Burton, 2015, p. 71). Communities that contribute to the well-being of their population are assumed to strengthen the individual ability to prepare and respond to different events (Ibid.).

- Educational attainment – Percent of population with at least a high school diploma

Education levels are connected with the socio-economic status of the population (Cutter, et al., 2003, p. 248; Copeland, et al., 2020, p. 4), where a higher education generally indicates a higher life-long earning than people with a lower education (Cutter, et al., 2003, p. 248). Education levels are also relevant for the Swedish context and was therefore included. Unemployment rates are rising among those without a high school diploma, and many of the employments that these people hold are time-limited, hourly payed and/or part-time (Arbetsförmedlingen, 2018). People with a high school diploma contributes therefore to a higher resilience score.

- Income level – Percentage of population with average or higher income level

Per capita income indicates how well an individual person can cope with the consequences after an event (Burton, 2015, p. 79), and was therefore included in this thesis. Income levels are also an aspect that determines an individual's capacity to take on loans.

This indicator is not included in the original BRIC, but several social vulnerability indexes include this indicator because it serves as a proxy for understanding an individual's financial situation (Wagner, 2018, p. 21). However, income level alone without regarding the expenses (rent, high loans, etc.) and family structures (Marzi, et al., 2019; Scherzer, et al., 2019) could be misleading. This aspect is further discussed in section 7.1.1.

- Working age – Percent of population between ages 15 – 67

It is assumed that people of working age have a better physical capability to help themselves and others in critical situations (Scherzer, et al., 2019, p. 4). The ages 15 – 67 are chosen with the assumption that people of working age in Sweden often are within those ages. The physical capabilities could be beneficial when an accident has occurred or in a crisis, which is the reason for including this indicator. However, this indicator does not regard the experiences of elderly that could be beneficial in critical situations where physical capabilities do not necessarily matter to the same extent (Copeland, et al., 2020, p. 5).

- Swedish language competency – Percent of population that has been enrolled on the Swedish for immigrants (SFI)⁹ course during the past 5 years

Language competency is important because it enables the understanding of information given by authorities when an accident has occurred or during a crisis (Cutter, et al., 2014, p. 75). During the initial face after an occurred event, the information from authorities to the public are in Swedish, which is the main reason for including this indicator. Language can also indicate how recently a person immigrated to Sweden and indirect how well adapted and how much knowledge a person has about the Swedish society. However, there are some difficulties with measuring this indicator because it is difficult to statistically determine the language competency. The chosen language capacity measurement “Percent of population that has been enrolled on the SFI course during the past 5 years” is chosen because it is mandatory for all newly arrived immigrants (SKR, 2019).

- Non-special needs – Percent of population that are not dependent on special assistance (elderly care, personal assistance)

People with special needs are generally regarded as more vulnerable because of their disability and contributes therefore for decreasing the community resilience (Scherzer, et al., 2019, p. 4). However, it is important to emphasize that disabilities vary, and people with disabilities are not automatically vulnerable. Wagner (2018, p. 44) also discusses the difficulties with finding available data on this indicator. Therefore, the indicator could potentially be disregarded from and/or adapted in future studies with regards to the difficulties of finding available data.

The reason for including this indicator is mainly because there could be benefits of understanding what kind of assistance the population in a municipality needs in the response face of an occurred event.

⁹ Svenska för invandrare

- Health services – Number of medical care staff per capita

This indicator was originally two different indicators “Mental health support” and “Physicians per 10,000 ppl” but has due to limitations in this thesis been merged into one. Many health care facilities in Sweden have both mental and physical health care, such as the primary care, which could imply that the two different indicators could overlap to some extent. Health services is furthermore an important indicator that increases the overall physical and mental health in a community (Cutter, et al., 2014, p. 68), and was therefore included in the questionnaire.

4.1.2. Economic resilience

Economic resilience measures the community assets and the degree to which resources are evenly distributed (Burton, 2015, p. 71). This category aims to measure the community’s economy and not the individuals’ (Ibid.). The economy of the community can indicate how well a community can prepare for and recover from an event (Ibid.).

- Employment rate – Percentage of the population employed

The employment rate is a proxy variable to measure the economic vitality of the community (Cutter, et al., 2014, p. 68; Scherzer, et al., 2019, p. 4). Higher employment contributes to higher income for the municipality through taxes. An employment could also indicate that people are a part of society, integrates and meets other people on a daily basis. This indicator was included in the questionnaire with regards to the reasons mentioned.

- Income equality – Gini-coefficient

This indicator was originally two different indicators “Race/ethnicity income equality” and “Gender income equality” but has due to limitations in this thesis has been merged into one. Inequalities in a community can increase the consequences in the aftermath of an occurred event (Logan & Guikema, 2020, p. 1543), and has an impact on the growth of the community (Roth, 2018, p. 27). Economic inequalities also lead to higher crime rates, increases risks for economic instability and crisis (LO, 2019). This indicator was included in the questionnaire with regards to the impacts that inequality can have on a society. This indicator is measured with the help of the Gini-coefficient, which is an economic measure of inequality.

- Single sector – Number of employments in the same industry per capita

The original indicator in BRIC was “Non-employed in primary/tourist industry” but was changed to single sector employment. This change was done because the economy of the community is more likely to be affected if there are no variety of employment opportunities, i.e., if many within a community are employed within the same industry (Amundsen, 2012, p. 4). This indicator is

especially relevant for several Swedish municipalities whose economy are dependent on a certain industry (such as farming, mining, forestry), which is the main reason for changing and including this indicator.

- Public tax-financed employment – Number public tax-financed employments per capita

The number of people employed within the public authorities facilitates the response and resupply during and after occurred events (Scherzer, et al., 2019, p. 4). Public tax-financed employments are furthermore safer because they are not dependent on profit-margins and are therefore less dependent on economic conditions and incidents, which is the reasons for including this indicator.

4.1.3. Community capital

Community capital aims to reflect the populations engagement in the community (Cutter, et al., 2014, p. 68). An engaged population reflects social networks and bonds within the community that can be beneficial the in the response and recovery phase of an occurred event (Ibid.).

- Political engagement – Percent of population that votes in the general election

High participation in election indicates that the population is politically engaged (Opach, et al., 2020, p. 194). Voting participation also reflects how strong the democracy is in the community which in turn indicates trust for governmental institutions (Marzi, et al., 2019, p. 4). This indicator was included in the questionnaire with regards to the reasons mentioned.

- Community involvement – Percent of population involved in various leisure activities (religious, sport, cultural)

This indicator was originally two different indicators “Social capital religious affiliation” and “Social capital civic organisation”, but due to limitations these two were merged. Both indicators are proxies for measuring the populations involvement which in turn indicates the social network within the community. Social networks can provide informal safety and support in crisis and could also contribute to a faster recovery after (Marzi, et al., 2019, p. 4; Scherzer, et al., 2019, p. 4). However, the variable which measures this indicator will only include active members in organisations and not all that take part of various leisure activities.

- Social capital – disaster volunteers – Percent of population thar are active in FRG¹⁰

High levels of disaster volunteers increase the likelihood to cope well during adverse events (Cutter, et al., 2014, p. 68), and was therefore included in the questionnaire. The original indicator measured

¹⁰ Frivilliga resursgruppen

number of Red Cross volunteers, which was not entirely relevant in the Swedish context. FRG is an organisation that coordinates the help from 18 different disaster volunteer organisations in Sweden. All members in FRG are obligated to undergo a 36h long training course which include CPR, first aid and basic fire safety knowledge (MSB, 2020). Each municipality have written agreements with the active FRG members (Wiro, 2020), which enables the measurement of the indicator on a municipal level.

4.1.4. Institutional resilience

The institutional resilience domain aims to capture aspects related to community governance and crisis management (Scherzer, et al., 2019, p. 4).

- Mitigation spending – Average amount spent per capita on mitigation and prevention measure (SEK)

Mitigation spending contributes to build up the institutional capacity for resilience (Cutter, et al., 2014, p. 75). Mitigation and prevention are emphasized as important in both LSO and LEH (SFS, 2003:789; SFS, 2006:554), which is the main reason for including and changing this aspect to not only include mitigation projects but also adding prevention projects.

- Disaster experience – Number of events that the municipality have applied for state compensation according 7 Chapter 3§ LSO (2003:778) and/or 5 Chapter 1§ LEH (2006:544)

Experience from past loss-causing events contributes to higher resilience for future events (Feldmeyer, et al., 2019, p. 7). The indicator reflects an institutional learning for future events and was therefore included in the questionnaire. However, adverse events which municipalities prepare for and mitigated could result in minor consequences and hence, not generate any compensation claims, but still contribute to experience.

- Performance regime – Mean distance to emergency services (police, fire rescue service, ambulance)

Closeness to emergency services affects the adaptation capacity (Marzi, et al., 2019, p. 4), facilitates response and resupply during and after an occurred event (Scherzer, et al., 2019, p. 4). The LSO act states that there should be a satisfactory and equal protection against accidents (SFS, 2003:789), and the travel time for emergency services are an important factor of fulfilling that paragraph in the law. This indicator was included in the questionnaire with regards to the reasons mentioned.

- Population stability – Absolute in/out migration as percentage of population

This indicator is a proxy measurement for population change (Opach, et al., 2020, p. 194) and was included with regards to issues with decreasing populations in many rural areas. A decreasing

population contributes to lower municipal income through taxes, which in turn leads to less resources to invest in municipal services.

4.1.5. Infrastructure/housing

This category aims to indicate how well a society can respond and recover from crises (Burton, 2015, p. 71). The category also provides an indication of how vulnerable infrastructures could be to various crises (Ibid.).

- Temporary shelter possibility – Number of hotel/motels per capita

This indicator is relevant if an adverse event results in a need of temporary housing options (Félix, et al., 2013, p. 136; Johnson, 2007, p. 435). Temporary shelter for a large group of people is not likely to be relevant when an accident has occurred, but during a crisis this could become important. For example, during 2015 there was a big inflow of immigrants and refugees which created a high demand on housing opportunities. This measurable variable is in line with the way Cutter et al. (2014, p. 70) measures this indicator.

- School restoration potential – Number of schools per capita

Access to schools is linked to the response and adaptive capacity of a community because schools can serve as a temporary sheltering, but also indicates how equally distributed the resources are among communities (Burton, 2015, p. 79). Closeness and access to schools are an incentive for people to stay in a community or move into a community (Burton, 2010, p. 78; Logan & Guikema, 2020, p. 1546). This indicator was included with regards to the mentioned reasons and the measurable variable is in line with the way Cutter et al. (2014, p. 70) measures this indicator.

- Industrial re-supply potential – Mean capacity of train stations, airports, ports, major roads

The potential to re-supply necessities to a community after an occurred event facilitates the response and recovery process (Burton, 2015, p. 71). Scherzer, et al. (2019) included all re-supply entry ways, such as central stations for trains, ports, larger road networks and airports to fit the Norwegian context. This indicator was therefore adapted to include all above mentioned re-supply entry ways.

- Communication capacity – Percent of population with a smartphone

Communication and access to information are crucial aspects for people's ability to cope with and adapt to different events (Marzi, et al., 2019, p. 4; Scherzer, et al., 2019, p. 4), and was therefore included in the questionnaire. However, there were difficulties with deciding how this indicator should be measured, which is further discussed in section 7.1.1.

4.1.6. Environmental resilience

The environmental resilience domain aims to capture the capacities to serve as a resource or buffer against environmental threats (Burton, 2015, p. 74).

- Natural flood buffer – Area wetland

Wetlands are the environment's natural way to protect against floods (Feldmeyer, et al., 2019, p. 10), but also contributes to clean water, storing excess water, as well as protection of water reservoirs during dry periods (Naturvårdsverket, n.d.). The indicator was included in the questionnaire with regards to all above mentioned reasons.

- Pervious surfaces – Area permeable land

Pervious surfaces are important to take into regard in cities where many surfaces are built up (Feldmeyer, et al., 2019, p. 13), and was therefore included in the questionnaire.

4.2. Excluded indicators

All the excluded indicators are analysed and discussed in this sub-section. The excluded indicators are presented in Table 2. Each indicator is further discussed below the category to which it belongs.

Table 2. The indicators that were excluded from the questionnaire.

Subdomain	Aspect	Indicator
Social resilience	Transportation	Percent of household with at least one vehicle
	Health insurance	Percent of population under age 65 with health insurance
	Food provision capacity	Food security rate
Economic resilience	Homeownership	Percent owner occupied house units
	Business size	Ratio of large to small businesses
	Large retail-regional/national geographic distribution	Large retail stores per 10,000 persons

Community capital	Not recent immigrants	Percent of population not foreign-born persons who came to Sweden within previous five years
	Native born residents	Percent of population born in state of current residence
	Disaster preparedness and skills	Red cross training workshop participants per 10,000 persons
Institutional resilience	Flood/crop insurance coverage	Housing units covered by National Flood Insurance Program/ Crop insurance policies per square mile
	Jurisdictional coordination	Governments and special districts per 10,000 persons
	Local disaster training	Percent of population in communities with Citizen Corps program
	Nearest metro area	Proximity of county seat to nearest county seat within a Metropolitan Statistical Area
	Nuclear accident planning	Percent of population within 10 miles of nuclear power plant
Infrastructure/ Housing	Sturdier housing types	Percent of housing units not manufactured homes
	Temporary housing availability	Percent vacant units that are for rent
	Medical care capacity	Hospital beds per 10,000 persons
	Evacuation routes	Major road egress points per 10,000 persons
	Construction quality	Percent housing units built prior to 1970 or after 2000
	High speed internet infrastructure	Percent of population with access to broadband internet service

Environmental resilience	Local food supply	Farm marketing products through Community Supported Agriculture per 10,000 persons
	Efficient energy	Megawatt hours per energy consumer
	Water use	Inverted water supply stress index

4.2.1. Social resilience

- Transportation – Percent of household with at least one vehicle

A vehicle and sufficient exit routes indicate that individuals can evacuate themselves if needed (Burton, 2015, p. 71), and a vehicle in the household serves therefore as a proxy variable for measuring transportation capacities (Scherzer, et al., 2019, p. 8). Also, evacuation in an own vehicle facilitates the ability to bring personal necessities. However, this indicator was not included in the questionnaire as major and acute evacuation due to natural or man-made hazards are not likely to occur in Sweden. During the past 30 years, one major evacuation has occurred in Sweden, which was the evacuation of Kävlinge in 1996 and evacuation possibilities for those who could not evacuate themselves were provided by the authorities (SOU, 2001, pp. 45-54).

- Health insurance – Percent of population under age 65 with health insurance

The importance of having a health insurance may be greater in USA, because the health care in Sweden is accessible for everyone. This indicator may be relevant to adapt or change in future studies if private health care insurances have greater influence on the health care system in Sweden. However, there are other insurances such as home insurance¹¹ and accidental insurance¹² which could be beneficial for individuals to have. Approximately 97% of Swedish household have home insurance (Svensk Försäkring, 2019, p. 4) and it is therefore not relevant to include home insurance as an indicator. Also, accidental insurances are mainly payed by employers (Ibid.) and is therefore not relevant to include either. The indicator “employment rate” which is included in the questionnaire could serve as a proxy measure for percent of population that has an accidental insurance. Another important factor to regard in the Swedish context are social tax-payd insurances for unemployed, orphans, sick people, etc. This indicator was further not changed to include insurances because of the reasons mentioned in this paragraph.

- Food provision capacity – Food security rate

¹¹ Hemförsäkring

¹² Olycksfallsförsäkring

This indicator is not applicable in Sweden with regards to the social insurances, hostels for the homeless, the church and organisations that support homeless people, etc. This indicator could potentially be relevant to include in the future due to the growing issue with people in Sweden with no access to food (Säfström, 2019).

4.2.2. Economic resilience

- Homeownership – Percent owner occupied house units

Homeownership is related to the economic vitality of the community (Cutter, et al., 2014, p. 68). However, there are differences between owning property and having high loans and owning property without having high loans. With regards to the ambiguity to whether the indicator contributes to increased resilience, this indicator was excluded.

- Ration large/small business – Ratio of large to small businesses

Large businesses are generally more capable of absorbing shocks than smaller businesses because of the assumption that large businesses have a larger network and more resources (Opach, et al., 2020, p. 184). Approximately 40 % of people employed within various businesses work in a small business (Tillväxtverket, 2020). Small businesses have ten or less employees (Ibid.). The majority of all small businesses in Sweden work with farming, forestry and fishery (Ibid.) and these businesses are generally located in the same geographical area in Sweden. This indicator could to some extent be covered by the indicator “Single sector”, which was partly the reason for excluding the indicator.

Another reason for excluding the indicator was the ambiguity of the indicators’ effect on community resilience with regards to LSO and LEH. An accident in a large business could lead to a large group of people suddenly becoming unemployed, which could have an effect on the community resilience. But during a crisis, smaller businesses could be more affected because of limited resources to cope with the crisis and would therefore have to apply for bankruptcy or reduce the number of personnel.

- Large retail-regional/national geographic distribution – Large retail stores per 10,000 persons

Accessibility to services such as commercial shops will increase the likelihood that people will stay and/or move into a community (Logan & Guikema, 2020, p. 1539). This indicator also contributes to the economic vitality of the community, i.e., if there are high demands in a community there will be more stores and more people will consume (Opach, et al., 2020, p. 184). However, internet shopping has had a significant upswing the past years and will likely become more popular in the future (Svensk Handel, 2018), which is the main reason for excluding this indicator. The prices are

generally lower in internet stores than in physical stores, which is an incentive for people to shop online.

4.2.3. Community capital

- Not recent immigrants – Percent of population foreign-born persons who came to Sweden within previous five years

People who recently arrived in the country will contribute to a lower community resilience (Cutter, et al., 2014, p. 69). Recently immigrated people are likely to have less knowledge and are less integrated in the Swedish society than others who have lived in the country longer. However, this indicator does not regard how well adapted these people are or their individual capacity and language competency. Copeland (2020, p. 6) also argues that some immigrants have travelled far and created a social network throughout the travel, and therefore they could be more resilient even though they arrived recently to the country.

This indicator was excluded partly because it would to some extent be covered by the indicator “Swedish language competency”, but also because of the ambiguity in how it contributes to community resilience.

- Native born residents – Percent of population born in state of current residence

In the study by Cutter, et al. (2014, p. 71) there was indication of high resilience in states where many people were born in the same state as residence in combination with many active in religious organisations. The combination of these indicates strong bonds and social networks within the community (Ibid.). Due to limitations in this thesis this indicator was excluded, and the indicator “Population stability” was instead included. Movement in/out of the community will contribute to a lower likelihood of creating strong community bonds.

- Disaster preparedness and skills – Red cross training workshop participants per 10,000 persons

Disaster training can facilitate the response to a crisis (Cutter, et al., 2014, p. 75). Also, the training and education that FRG members can undergo, apart from the 36h compulsory training, are dependent on the needs identified in each municipality through the RVA (Wiro, 2020). If a need is identified, the municipality funds the organisation to educate individuals in a certain area (Ibid.). This indicator was excluded because the indicator “Social capital – disaster volunteers” does to some extent include disaster preparedness and skills with regards to the compulsory 36h training that active FRG members undergo.

4.2.4. Institutional resilience

- Flood insurance coverage and Crop insurance coverage – Housing units covered by National Flood Insurance Program/Crop insurance policies per square mile

Flood and crop insurance contribute to build up the institutional capacity for resilience (Cutter, et al., 2014, p. 75). As previously mentioned, a significant majority in Sweden are covered by home insurances (Svensk Försäkring, 2019), and if there are major losses due to floods or major droughts there are generally state aid available to cover the losses (Regeringskansliet, 2010). Some examples are when Malmö was flooded in 2014 (SOU, 2017) and the droughts that affected the farming industry in 2018. Both of these adverse events lead to losses that was partly covered by state aid (SOU, 2017; Regeringskansliet, 2010). With regards to the reasons mentioned above, these indicators were excluded.

- Jurisdictional coordination – Governments and special districts per 10,000 persons

This indicator is not applicable, because there are no special jurisdictional districts¹³ in Sweden.

- Local disaster training – Percent of population in communities with Citizen Corps program

Local disaster training can differ depending on the environment and hazardous industries in an area. Some example of local disaster training is the evacuation information distributed to people living close to a nuclear power plant (Cutter, et al., 2014, p. 70). The municipalities, authorities, emergency services and so forth do most likely have their own planning, training and exercises in Sweden. However, there are issues with defining what counts as disaster training which complicates the measurement of this indicator, and this indicator was therefore excluded.

- Performance regime - nearest metro area – Proximity of county seat to nearest county seat within a Metropolitan Statistical Area

Smaller, rural areas tend to receive help and resources from larger cities in a crisis (Cutter, et al., 2014, p. 68). This indicator serves as a proxy for the closeness of larger cities and therefore the closeness of backup resources if the local resources are insufficient (Ibid.). Smaller municipalities often have collaboration with other adjacent municipalities in Sweden, where these municipalities share resources with each other. With regards to these collaborations, this indicator was excluded.

- Nuclear plan accident planning – Percent of population within 10 miles of nuclear power plant

¹³ Independent, special-purpose governmental districts that exists separate from local government with substantial administrative and fiscal independence.

This indicator is hazard specific and is therefore not chosen due to limitations in number of included indicators. There are only 4 nuclear power plants in Sweden, and this indicator is therefore only applicable in four specific geographical areas. It could be relevant to include some kind of accident planning for all hazardous industries, such as industries covered by the SEVESO legislation as well as nuclear power plants. But due to limitations in this thesis and the special legislations that regulates these industries, this indicator has been disregarded in this thesis.

4.2.5. Infrastructure/housing

- Sturdier housing types – Percent of housing units not manufactured homes

Approximately 6 % of households in USA are houses that does not count as sturdy, which means that the foundation of the house is not attached to the ground and are therefore easily destroyed in a tornado (Cariolet, et al., 2019, p. 8). Tornadoes does not generally occur in Sweden, which invalidates this indicator as a proxy for community resilience, and thus it was excluded from the questionnaire.

- Temporary housing availability – Percent vacant units that are for rent

This indicator was discussed in included indicator “Temporary shelter possibility”, but there are differences in how they are measured. Because of limited knowledge of how the variables “Number of hotel/motels per capita” and “Vacant housing for rent” impact resilience, only one (Number of hotels/motels per capita) was included due to limitations in this thesis.

- Medical care capacity – Hospital beds per 10,000 persons

Number of hospital beds per capita are easy to calculate and could be a proxy for medical care capacity (Cutter, et al., 2014, p. 70). However, it is more important to include number of medical personnel or equipment rather than counting beds, which is one reason for excluding this indicator. Also, the closeness to medical care is more important when accidents occur. It is further not likely that the capacity is not sufficient during an accident, but during a crisis the medical capacity could become an issue.

- Evacuation routes – Major road egress points per 10,000 persons

This indicator was not included in the questionnaire because major and acute evacuation are not likely to occur in Sweden. See discussion below the indicator “Vehicle in household”, sub-section 4.2.1.

- Construction quality – Percent housing units built prior to 1970 or after 2000

Houses in USA that are built prior to 1970 and after 2000 are more resilient (Cutter, et al., 2014, p. 70). These aspects are not relevant for buildings in Sweden because of the building regulations that exists in Sweden, which is partly the reason for excluding this indicator. Constructions are rarely destroyed in Sweden due to an accident or a crisis, and the destruction is most likely caused by the severity of the event rather on when the construction was built. Building locations could however be more important to regard than construction quality (MSB, 2011b, p. 52), for example, closeness to water, landslide prone areas, etc.

- High speed internet infrastructure – Percent of population with access to broadband internet service

This indicator was excluded from the questionnaire because it is partly covered by the indicator “Communication capacity”, presented in sub-section 4.1.5.

4.2.6. Environmental resilience

- Local food supplies – Farm marketing products through Community Supported Agriculture per 10,000 persons

Cutter, et al. (2014, p. 75) includes but also criticises this indicator as it does not measure the capacity of the local food production in relation to the population, but only measures the quantity of farms. In Sweden, the local food production is important because it accounts for approximately 50 % of all consumed food. However, if there were disruptions on the local food production this would be a national issue rather than a municipal issue, which is the reason for excluding this indicator.

- Efficient energy use and water use - Megawatt hours per energy consumer/ Inverted water supply stress index

Clean water and sanitation and affordable and clean energy are two of the Agenda 2030 sustainable development goals (UN, 2015). Clean water is not an issue in Swedish households and the price for energy was one of the lowest in Europe in 2018 (Energimyndigheten, n.d.), which was the reason for excluding these two indicators. However, climatic changes could in the future contribute to droughts, which in turn could lead to limited fresh water. Also, the transition from nuclear energy to renewable energy is highly debated in the Swedish parliament. Depending on where and how the electricity is produced in the future, the affordability of energy could change and become an issue.

5. Questionnaire and interviews

The purpose of the conducted questionnaire and subsequent interviews was to get an understanding of the professionals' views on community resilience, the BRIC method and the 23 included indicators. Both the questionnaire and the subsequent interviews were aimed at professionals' working with prevention, preparedness and response planning for accidents and crises.

5.1. Questionnaire

The questionnaire was divided into two parts, where the first part aimed at understanding the respondents' occupation and main responsibilities, the size of the municipality they work in and what legislations that they work with. This part of the questionnaire also aimed at understanding the respondents' familiarity with and their view on community resilience, as well as examining whether community resilience can add new perspectives to prevention, preparedness and response planning for accidents and crises.

The second part of the questionnaire explained the BRIC method and presented all six categories as well as the 23 included indicators. Each category was presented as a question, where the purpose of each category was explained. The respondents were asked to tick all indicators they thought would add some value and perspective in their professional role. This part of the questionnaire mainly aimed at investigating if the BRIC method, and more specifically if the included indicators could provide relevant information to professionals working with accident and/or crisis management.

The questionnaire was originally sent out in Swedish, but a translated version is found in Appendix 2 – Questionnaire. An overview of the respondent's answers to the questionnaire are presented in section 6, and the respondents' full answers are presented in Appendix 3 – Results from questionnaire.

5.2. Interviews

Interviews were conducted to better understand the answers from the questionnaire. Totally 16 of the 34 respondents were contacted for an interview, some for a shorter interview and some for a more detailed interview.

As previously mentioned, the questionnaire was sent out to 52 people working in different municipalities in Skåne, and 34 filled in the questionnaire. However, 14 did not respond to the part of the questionnaire asking about BRIC, the six categories and the indicators. Of these 14 people,

12 of those were contacted through telephone to understand the reason for not completely filling out the questionnaire, the other 2 were asked for a more detailed interview. These short interviews only aimed at understanding the reason for not completing the questionnaire and were therefore not transcribed.

Five persons were contacted and asked for a more detailed interview. They were chosen based on their answers on the questionnaire. More specifically, the choice was based on:

- If the respondent thought that resilience would bring in new perspectives and thought that BRIC could contribute to their work.
- If the respondent thought that resilience would bring in new perspectives, but BRIC was not the method to use.
- If the respondent did not think that resilience gave new perspectives.

The reason for conducting these interviews was to get a deeper understanding of the respondents' perspectives on resilience and BRIC with regards to the three points listed above.

The two interviews were conducted through a digital platform and could therefore be recorded and transcribed. An overview of the results from the interviews is presented in section 6 and a more detailed summary of the two interviews is found in Appendix 4 – Interviews. The other three respondents could not make time for an interview.

6. Questionnaire and interview responses

An overview of the results from the questionnaire as well as the interviews are presented in this section. An overview of the information about the respondents is presented in sub-section 6.1. In sub-sections 6.2. and 6.3., the results from the questionnaire and interviews are presented. This section only represents an overview of the questionnaire and interview responses. The complete questionnaire result is found in Appendix 3 – Results from questionnaire and a detailed summary of the interviews are found in Appendix 4 - Interviews.

6.1. The respondents'

There were 34 of 52 responses to the questionnaire. Of the 34 respondents, approximately half work at the municipal emergency rescue services, and the other half in other municipal administrations. The distribution of respondents with regards to the size of the municipality they work in is presented in Table 3.

Table 3. The size of the municipality where the respondents work.

Very large municipality	Large municipality	Medium municipality	Small municipality
> 100 000 ppl	40 000 < ppl < 100 000	15 000 < ppl < 40 000	< 15 000 ppl
32 %	21 %	35 %	12 %

There were responses from professionals working in all population categories.

Furthermore, 59 % of the respondents work solely with LEH, 29 % work solely with LSO and the remaining 12 % work with both legislations. In the questionnaire, there were also questions about whether the respondents have worked with either municipal RVA or action plans and what the respondents' main area of responsibility are (prevention and mitigation planning, response planning, operational work or other responsibilities). The majority of respondents had worked with either an RVA, a municipal action plan or both. Only 9 % of the respondents had never worked with either of the documents. Most of the respondents had several areas of responsibilities, but the majority work with preventive and mitigation planning. Some respondents specified in free text what other areas of responsibilities they have, some of which are different managerial tasks, security issues, crime prevention, public health issues, urban planning, contingency and civil defence planning.

6.2. Community resilience

The first part in the questionnaire aimed at getting an idea of how familiar the respondents are with the concept of resilience and if they have integrated resilience in their work. Of the 34 respondents, 88 % were familiar with the concept of resilience. Half of them had integrated the concept in their work and half had not. Only four of the respondents (12 %) were not familiar with the concept. Presented in Table 4 is the fraction of responses about familiarity with resilience, with regards to the legislation they work with.

Table 4. The distribution of responses with regards to the legislation the respondents work with.

	LSO	LEH
I am familiar with the concept and have integrated it in my work.	29%	58%
I am familiar with the concept but have not integrated it in my work.	50%	38%
I am not familiar with the concept.	21%	4%

The respondents that work with LEH were to a greater extent familiar with and integrated the concept of resilience into their work. Most of the respondents that do not integrate resilience in their work or are not familiar with the concept work with LSO. However, four of the respondents work with both legislations.

Figure 2 presents the fraction of responses about familiarity with resilience, with regards to the population categories.

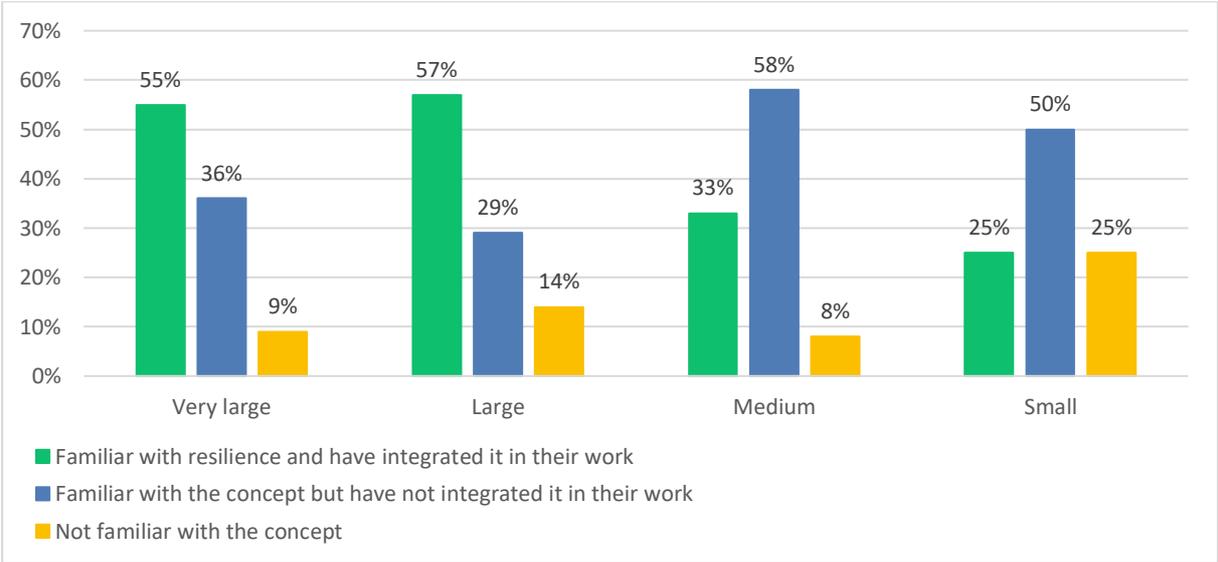


Figure 2. Distribution of respondents with regards to the size of the municipality they work in.

The green stacks represent the fraction of respondents in each municipality that are familiar with resilience and have integrated it in their work. Moreover, the blue stacks represent the fraction of respondents that are familiar with the concept but have not integrated it in their work. Finally, the yellow stacks represent the fraction of respondents that are not familiar with the concept. The respondents working in very large and large municipalities integrates resilience into their work to a greater extent than the respondents working in medium-sized and small-sized municipalities.

The questionnaire also aimed at understanding if the respondents thought that the resilience concept added some new perspectives in their work. The majority of the respondents (73 %) replied that resilience does add new perspectives, 6 % thought that resilience did not add new perspectives, 21 % did not have an opinion or did not know and one person did not answer. The response rates were similar between the respondents working with LSO and LEH, as well as between the different population categories.

6.2.1. Resilience – a new perspective?

The respondents who replied that resilience does add new perspectives were asked to fill in what new perspectives in free text. Also, one of the supplementary interviews addressed what new perspectives the interviewees perceive that the resilience concept entails.

One respondent wrote that resilience forces the organisation to think in other ways than only maintaining the goals and objectives that the municipality has set, and that resilience simplifies the work with how to reach these goals. Some other free text responses in the questionnaire were that resilience provides a broader view on an organisation's flexibility and ability to manage unforeseen events. Furthermore, resilience was perceived to entail a learning aspect that enables re-organising as well as adapting to a new state which facilitates the management of any future events and not only the events that just occurred. Flexibility, ability to manage unforeseen events and learning for future events were also mentioned by one of the interviewees working with LEH. Moreover, the interviewee said that the work done today is often scenario-based, where all scenarios and the capacity to manage those specific scenarios are analysed. The interviewee emphasized that the scenario-based work is good, however the occurred events are rarely identical to the practiced scenario which means that there needs to be more flexibility and adaptability to occurred events. However, the interviewee was new to the job and could therefore not comment on how learning took place in the municipalities. Furthermore, learning is important for evaluating the past and to better understand what did and did not work well according to the interviewee.

Another free text response was that there are issues with understanding that resilience and continuity planning are integrated in the work done, though the concepts have other names.

However, the other names that the respondent referred to were not clarified in the response. Furthermore, the respondent emphasized the need to use simpler expressions and applications so authorities can see it as their regular work and not something that is an extra load to the work they already do.

According to the other interviewee, who worked with LSO, resilience is already integrated in the emergency rescue service work and also said that their organisation is very good at managing unexpected events. However, the interviewee also stated that their organisation could certainly improve adaptation to and learning from occurred events but said that their organisation worked more with resilience than other departments within the municipality.

Finally, one of the respondents stated that the resilience concept would be better used in other municipal areas than with specifically LSO and LEH work. However, the respondent did not specify which other municipal areas.

6.3. The BRIC method

As previously mentioned, 14 out of 34 responders did not respond to the part of the questionnaire where the BRIC method was presented. Therefore, these 14 respondents were contacted in order to understand the reason for not responding. Listed below are the results from the phone calls.

- 7 of the 14 could not be reached.
- 2 of the 14 were asked for a more detailed interview.
- 4 of the 14 thought the questionnaire was too long, which lead to them skipping the second part.
- 1 of 14 did not completely remember but replied that the reason for skipping the second part of the questionnaire was most likely due to the irrelevance of the method for the work municipalities do.

Nonetheless, 20 of 34 respondents responded that at least one of the included indicators could contribute to knowledge and be valuable in their professional role. Of the 20 respondents, 5 work with solely LSO, 12 with solely LEH and 3 work with both legislations. Also, 7 of the respondents work in very large municipalities, 4 work in large, 7 work in medium and 2 work in small.

Presented in Figures 3 – 8 is the fraction of respondents on each indicator in the six categories that the respondents thought could be valuable in their professional role. Below each presented category, the respondents were asked if there are some additional indicators that they believed could contribute to community resilience with regards to the purpose of each category. The respondents were asked to keep in mind that the indicators had to be general for different

hazards/threats and quantifiable. All answers were given in free text and are presented in this section.

The response rate for the indicators presented below the category social resilience is presented in Figure 3.

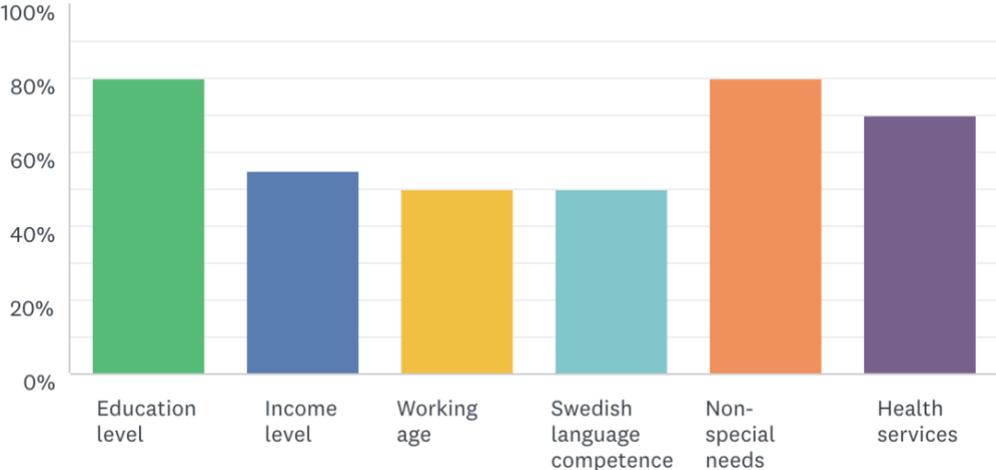


Figure 3. The stacks represent the fraction of respondents on each indicator under social resilience.

Both the indicator “Education level” and “Non-special needs” have a slightly higher response rate, but more than 50 % of all respondents thought that all indicators could be valuable in their professional role. The free text responses for the category social resilience are listed below.

- Child poverty
- Overcrowding
- Income support rates
- Sick leave rates
- Local trust, population trend (age of population in the future, increase/decrease of population)
- Percent of children in preschool
- Spoken languages (other than Swedish and English)
- General awareness of how vulnerable the society is

The response rate for the indicators presented below the category economic resilience is presented in Figure 4.

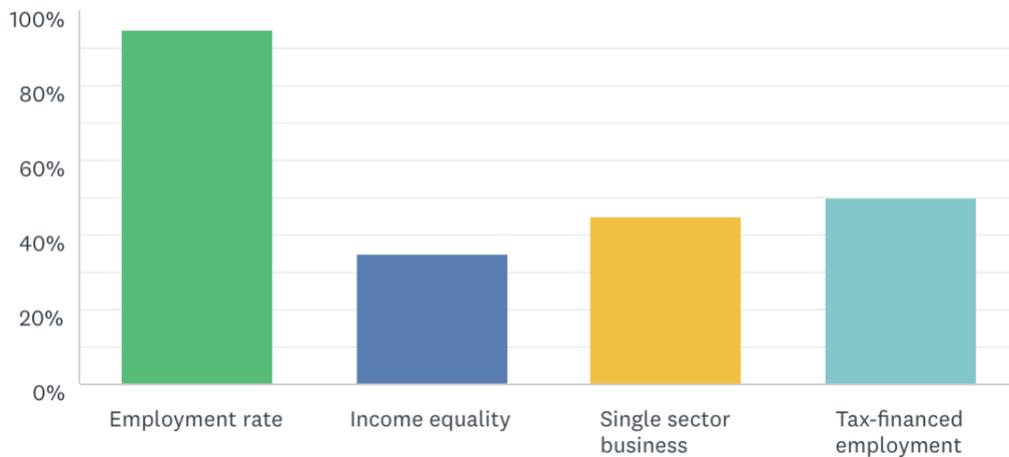


Figure 4. The stacks represent the fraction of respondents on each indicator under economic resilience.

Almost all respondents thought the indicator “Employment rate” could be valuable in their work. However, the other three indicators have 50 % or less response rate. The free text responses for the category economic resilience are listed below.

- Percent of income that goes to housing costs and loan-to-value ratio¹⁴
- Proportion of residents living on financial aid
- Overview of domestic production in comparison with import/export ratio

The response rate for the indicators presented below the category community capital is presented in Figure 5.

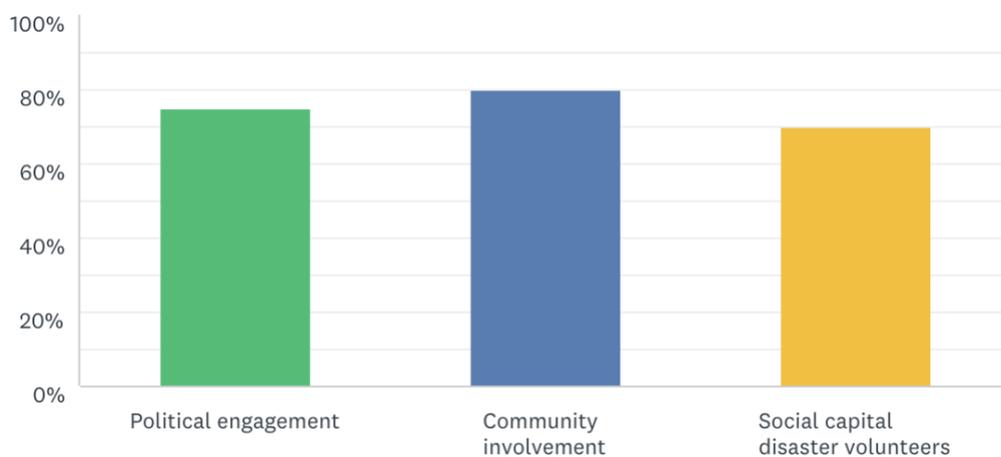


Figure 5. The stacks represent the fraction of respondents on each indicator under community capital.

¹⁴ Beläningsgrad

All indicators in this category have similar response rate, where almost all respondents thought the indicators did contribute to added knowledge in their professional role. The free text responses for the category community capital are listed below.

- Crisis education for children in school
- The populations attitude of working as a part-time firefighter
- Number of visits to the municipality’s webpage and social media platforms
- Other voluntary disaster organisation than FRG
- Membership is not the modern form of commitment. Involvement based on culture/language/religion/country could also be beneficial
- “Community capital” and “Social disaster volunteers” does not reflect aspects of this category

The response rate for the indicators presented below the category institutional resilience is presented in Figure 6.

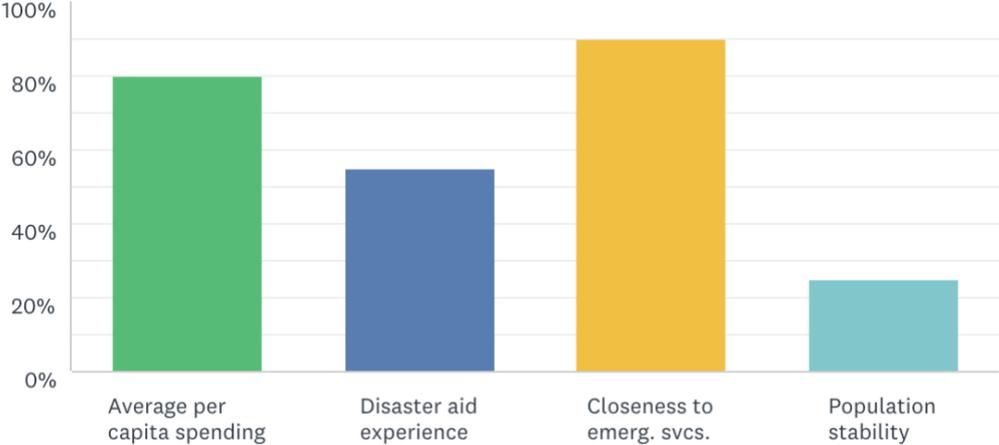


Figure 6. The stacks represent the fraction of respondents on each indicator under institutional resilience.

All indicators except for “Population stability” have more than 50 % response rate. Only 25 % of the respondents thought population stability contribute to knowledge in their professional role. The free text response for the category institutional resilience is listed below.

- The category is about the municipalities ability to see, adjust, act, which is not reflected in the proposed indicators in this category

The response rate for the indicators presented below the category infrastructural resilience is presented in Figure 7. Only 18 of the 20 respondents for the second part of the questionnaire answered the question about the indicators presented in this category.

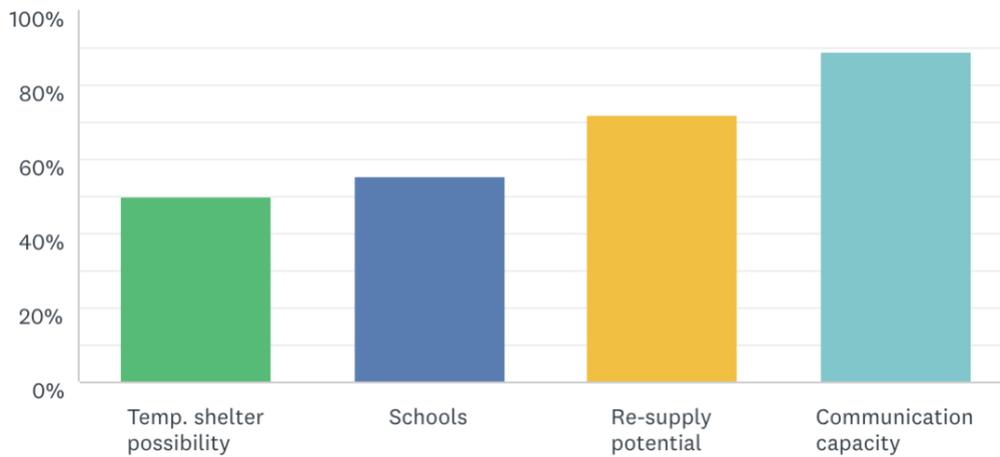


Figure 7. The stacks represent the fraction of respondents on each indicator under infrastructural resilience.

All indicators have 50 % or higher response rate. However, almost all respondents thought the indicator “Communication capacity” are valuable in their professional role. The free text answers for the category infrastructural resilience are listed below.

- Percent of population with access to own water/alternative water source
- Percent of population with their own heating (fireplace, etc.)
- Percent of population with access to radio
- Proportion of people that travels daily in/out from the municipality for work
- Perhaps access to internet instead of access to smart phone

The response rate for the indicators presented below the category environmental resilience is presented in Figure 8. Only 18 of the 20 respondents for the second part of the questionnaire answered on the question about the indicators presented this category.

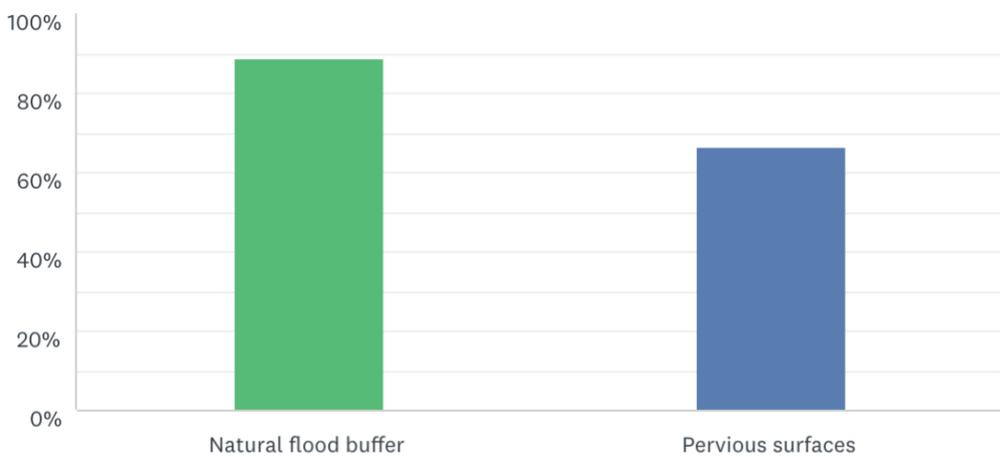


Figure 8. The stacks represent the fraction of respondents on each indicator under environmental resilience.

Both indicators in this category have more than 50 % response rate. The free text responses for the category environmental resilience are listed below.

- Sea levels
- Ground levels
- Building in coastal areas
- Proportion of forest land
- Purposed indicators only reflect the resilience for floods, but lacks indicators other environmental impacts

One of the final questions in the questionnaire asked if there were any additional indicators that were not suitable to include in the six purposed categories. The free text response to the question is listed below.

- Management capabilities, for example people in crisis management that are trained and educated

The response rates were similar on all indicators between the respondents working with LSO and LEH, as well as between the different population categories. The majority (70 %) of the free text answers are written by respondents that work with LEH.

6.3.1. BRIC a complement to prevention and preparedness planning for accidents/crisis

The final question in the questionnaire asked if the respondents had anything else to add. Free text responses and one of the interviewees who work with LEH stated that the BRIC method could not be used as the only tool to measure municipalities community resilience. However, the interviewee thought that the presented indicators could complement their work and specified that the method could be used when the overall mapping of the population is done in the municipal RVA.

Furthermore, one respondent thought that considerations had to be taken to collaborations and coordination between different public authorities and also regard how plans and measures are implemented in the municipality. Another response to the final question was that there should be some form of evidence that confirms the relevance of each indicator, considering there is a risk that some indicators are chosen only because they are measurable. Further, one respondent suggested the indicators in Agenda 2030 for sustainable development, for measuring resilience.

The other interviewee, who works with LSO, did not fill in the second part of the questionnaire and was therefore asked about the method and the different indicators during the interview. However, the interviewee did not think that a quantitative method was necessary with regards to

the size of the municipality where this person work. Because the municipality is small, the people in the emergency rescue service have enough knowledge about their population. However, the interviewee said that larger municipalities could benefit from a quantitative method for gaining knowledge about their population. Furthermore, the interviewee also said that some of the knowledge about the municipality was built on rumours and a quantitative method for measuring different aspects perhaps could be good in order to confirm or dismiss these rumours.

7. Discussion

This section presents a discussion about the indicators and BRIC, community resilience, limitations in this research as well as potential future studies on the subject.

7.1. BRIC and the indicators

One part of this thesis was to analyse whether the BRIC method and the indicators can provide valuable information for municipalities' work with prevention, preparedness and response planning for accidents and crises. Also, this thesis analysed if the BRIC indicators needed adaptation to fit the Swedish context. An adaptation and limitation of the original BRIC indicators was done in this thesis, partly to limit the number of indicators which were included in the questionnaire. However, according to Scherzer, et al. (2019, p. 3), there are no set of indicators that can be used for all contexts and adapting indicators to a specific context is essential. It is therefore fair to assume that adaptation of the BRIC method to the Swedish context is necessary.

Furthermore, the six categories for resilience were adopted from the original BRIC method. However, these categories are not necessarily suitable for all contexts (Scherzer, et al., 2019, p. 12). Also, the indicators in the categories institutional and infrastructural resilience were criticised in the questionnaire for not being suitable for the purpose of the category. In a future adaptation of the BRIC method, the six categories could potentially need adjustment to fit the local context as well as the indicators included in the category.

7.1.1. Indicators with higher and lower response rates

The response rates on the indicators presented in the questionnaire can indicate which of the included indicators that the respondents considered provides valuable information in their professional role. Furthermore, the rating of the indicators was quite similar regardless of whether the respondents work with LSO or LEH, as well as between the different population categories. It is therefore difficult to draw any conclusions on whether the indicators are more suitable for managing accidents or crises, or about differences in municipalities with different population sizes. Some of the indicators with higher and lower response rates will be discussed in this sub-section.

The indicators with lower response rates are not automatically irrelevant for professionals' working with prevention, preparedness and response planning. However, the respondent's background and area of responsibility can affect what the respondent perceives as a valuable indicator in their professional role, which could influence the response rate on the indicators. Income equality and population stability received lower response rates, which could be due to the difficulty with connecting them to accident and crisis management. However, both indicators do have an impact

on community resilience according to the selection of literature. For example, economic inequality can increase risks for economic instability and crises (LO, 2019). Also, inequalities could increase the consequences in the aftermath of an occurred event because there could be differences in an individuals' vulnerability to hazards (Logan & Guikema, 2020, p. 1543). It is also fair to assume that it can be difficult to determine whether indicators are relevant or not by only reading the information provided in the questionnaire. Furthermore, the indicators "Education level", "Employment rate", "Closeness to emergency services" and "Communication capacity" received a higher response rate. The high response rates could be due to the availability bias (Tversky & Kahneman, 1973), which in this context could be interpreted as the respondents more easily are able to understand how the indicators can impact their work with accidents and crises.

Two indicators that are relevant for measuring an individual's capacity to cope with and adapt to occurred events are "Income level" (Burton, 2015, p. 79), and "Communication capacity" (Marzi, et al., 2019, p. 4; Scherzer, et al., 2019, p. 4). Both indicators received high response rates and were also commented about in free text. However, income levels without regarding expenses could be misleading, which is in line with some free text responses that stated that housing costs, loan-to-value ratios, etc., should be regarded. There is an EU-project that aims to measure the European standard to poverty (because no one in Sweden would be regarded as living in poverty, i.e., living on 1,9 USD per day) (SCB, 2017). The aim of the EU-project is to measure income levels that are not sufficient for the basic needs such as rent, food, etc. (Ibid.). Also, the approach regards household compositions, which according to Scherzer, et al. (2019) and Marzi, et al. (2019) is important. Moreover, this approach could be used as an alternative way to measure "Income level".

Communication capacity is a critical aspect when an event has occurred (Marzi, et al., 2019, p. 4; Scherzer, et al., 2019, p. 4), and more specifically it is important with a two-way communication. However, there are difficulties with how to measure communication capacity. The choice "Access to smart phone" is not suitable because almost everyone in Sweden has access to a smart phone (Davidsson & Thoresson, 2017, p. 16). One of the free text responses suggested that communication capacity should measure "Access to internet" rather than "Access to smart phone". Nonetheless, both access to internet and smartphone are to no use if there are abruptions in the telecom system. The PTS¹⁵ authority that is responsible for the telecom system in Sweden does not have statistics over all abruptions in the telecom system (PTS, 2020). PTS only reports incidents with larger consequences and does not have statistics over a specific municipality (Ibid.). Incident

¹⁵ Post- och telestyrelsen

statistics would be required if it would be used in the BRIC method, and it is therefore difficult to measure “Communication capacity” by measuring disruptions in the telecom system.

7.1.2. BRIC – relevance for the Swedish context

It is fair to assume that most of the included indicators could provide relevant information for managing accidents and crises, with regards to the high response rates on most indicators as well the selection of literature chosen for screening indicators. However, the results from this thesis are not sufficient to present a complete set of indicators that measures community resilience in the Swedish context. It is further difficult to understand how the measurement of resilience contributes to facilitate the work with managing accidents and crises, because the method has never been tested and evaluated in practice. Moreover, it is difficult to know if the method measures resilience in the Swedish context because of the difficulty of empirically validating the indicators (Opach, et al., 2020, p. 182).

One of the respondents stated that there should be evidence that confirms the relevance of each indicator. The included indicators in this thesis have been selected on the basis of scientific literature which support their relevance for measuring resilience. However, the process of selecting and adapting indicators is a subjective process (Burton, 2015, p. 74; Copeland, et al., 2020, p. 2), and the included indicators would most likely differ if selected by someone with another background and knowledge than the author of this thesis. Also, the selection of indicators should be developed by collaborating with experts within the field of DRM (Scherzer, et al., 2019, p. 13).

The selection of indicators was one of the more difficult steps in this thesis, due to lack of knowledge about the impact of the indicators. It could potentially be beneficial to include expertise and literature from all the disciplines, i.e., an expert in and literature about social science, economy, and so forth when developing a set of indicators for Sweden. With the help of experts, it would likely simplify the understanding of the impact that the indicators have. The collaboration with experts within different disciplines could also contribute to more qualified assumptions about the indicators, even though the adaptation process will likely always include some subjectivity. Moreover, a statistical correlation analysis similar to what Cutter, et al. (2014) and Scherzer, et al. (2019) have done should be carried out. The correlation analysis would statistically determine which of the indicators that correlates and therefore limit subjective assumptions about correlations. Furthermore, the statistics of the adapted indicators should be easily accessible on a national level in Sweden, because the use of the method should not require an extensive data collection. The statistics for most of the included indicators are easily accessible, however, the focus in this thesis were not on including an indicator based on the accessibility of data. Examples of indicators that could potentially be difficult to find easily accessible data on are “Non-special needs” and

“Community involvement”. Finally, no set of indicators could be used to measure resilience without having some regular changes to the chosen indicators over time. The context is constantly changing with climatic changes, change of regulations, and so forth, and for the method to be suitable for measuring resilience there should be changes to the method as well.

Moreover, quantitative methods are used to simplify complex realities (Scherzer, et al., 2019, p. 13), which is in line with one of the respondents who stated that a quantitative method could not be the only tool for measuring community resilience and other aspects are important to regard. Aspects such as collaborations and relations, which are often important in a crisis are disregarded in BRIC (Ibid., p. 3), and should be included when analysing the community resilience. It is therefore fair to assume that BRIC should not replace existing planning tools but could potentially complement the work done with managing accidents and crisis.

7.1.3. Difficulties with BRIC and the indicators

Indicators are as mentioned used as proxies to measure aspects of resilience and are thus not an exact measurement of resilience (Cimellaro, 2016, p. 62). Resilience is further a difficult concept to measure quantitatively, and the results from the BRIC method should therefore be analysed cautiously. It is fair to assume the BRIC method could be used to generate a score which is further used to identify parts that could benefit of implemented measures. However, it is important not to focus on achieving a higher BRIC score by implementing measures.

Other difficulties with BRIC are that the method combines all the indicators into one resilience score. However, although each indicator reflects an aspect of resilience, it is not a certainty that the combination of all the included indicator scores merged together reflects on the community resilience. Furthermore, there is not a direct cause-effect relationship between an indicator and the reality, and it is therefore fair to assume that a quantitative index method such as BRIC uses several indicators that together reflects an aspect of reality. Several indicators have in this thesis been excluded, which could potentially affect what the combination of indicators reflects on in reality. However, it is difficult to determine how the exclusion of indicators have affected the precision of the methods’ measurement of community resilience.

7.2. Community resilience

One of the research questions in this thesis was whether resilience can contribute with new perspectives to prevention, preparedness and response planning for accidents and crises. Most of the respondents in the questionnaire replied that the concept does add new perspectives. However, the free text responses contribute to some ambiguity in whether the concept adds new perspectives or if resilience is already a concept implemented in the work done. According to some free text

responses, resilience entails a flexible and adaptable approach, which are missing from the organisation. However, another free text response states that the expressions and applications of the concept needs to be simplified for their organisation to better understand that resilience is already implemented in the work done. The ambiguity in whether resilience is a new concept or just a new name for already implemented principles and strategies is also an issue that Bergström (2018, p. 37) writes about.

7.2.1. Integrating resilience in their work

Most of the respondents who considered that aspects of resilience are integrated in their job work with LEH. An assumption that can explain the overrepresentation of LEH respondents to this question is that crisis management often include several parts of the community and a holistic perspective is therefore of great importance. Even though accidents could potentially lead to a crisis, the work with accident prevention is assumed to be narrower and not include perspectives such as crime prevention, social issues and so forth.

7.3. Limitations

The questionnaire and subsequent interviews aimed to better understand professionals' view on community resilience and the BRIC method. However, there are several aspects to regard when analysing their responses. Some of which are that the respondents have various areas of responsibility and work in municipalities with various risk profiles. It is therefore of great importance to regard the variety in their areas of responsibility, background and knowledge when analysing the questionnaire responses and interviews. In this thesis, some analysis has been done with regards to what legislation the respondent work with as well as the municipality size which they work in. However, there are other aspects that could contribute to the response that each specific individual made. The time frame of this thesis, however, did not allow an individual analysis of each questionnaire response.

Furthermore, even though questionnaires facilitate data collection from a larger group of people, the use of questionnaires also limits what responses that can be collected, and it is difficult to fully know how the respondent perceives the questions. Several respondents could have potentially provided a more nuanced answer if given the opportunity to further elaborate the response but was limited due to scope of the questionnaire. The responses could have been elaborated with the help of more interviews.

Finally, the questionnaire and the interviews can only give an indication of professionals' views on community resilience and the BRIC method. The number of respondents is not enough to determine with statistical certainty whether community resilience adds new perspectives or if the

BRIC method and the suggested indicators contributes to knowledge for managing accident and crises. Also, the questionnaire was only sent out to professionals working in Skåne, and the result could potentially be different if professionals from the whole country were given the opportunity to respond to the questionnaire.

7.4. Future studies

There are several other indicators that could be relevant to include in a future set of indicators adapted for the Swedish context that are not included in this thesis or in the original BRIC. Some of the free text responses suggested indicators that could be relevant to include, some of which are “Crisis education in pre-school” and “Access to own water and heating”. These indicators could be interesting to analyse further and include in a future set of indicators for the Swedish context.

One respondent suggested that the goals in Agenda 2030 for sustainable development could be regarded. Presented in sub-section 4.2.6. are two of the excluded indicators about “Efficient energy use” and “Water use”, which are both goals in the Agenda 2030 (UN, 2015). One of the free text responses in the questionnaire was that alternative water sources and heating sources should be included in a set of indicators for Sweden. Future studies on the subject could consider including indicators that measures access to water and energy sources.

Furthermore, the goals 11 “Make cities and human settlements inclusive, safe, resilient and sustainable” and goal 13 “Take urgent action to combat climate change and its impacts” (UN, 2015) are the most relevant to analyse if the aim is to measure community resilience in a Swedish context. Examples of the target goals included in goal 11 are improving road safety and expanding public transportation, reduce number of deaths and those affected by severe economic losses (Ibid.). Most target goals in goal 13 aims to improve how climate change is managed by including climate change policies in national strategies and planning, and also improve the education and awareness-raising on climate change mitigation, adaptation, impact reduction and early warning (Ibid.). An analysis of the target goals could be done, and indicators to measure each goal can potentially be relevant to include in a set of indicators for Sweden.

8. Conclusions

This thesis aims to investigate whether the concept resilience adds new perspective to prevention, preparedness and response planning for accidents and crises in Sweden. Furthermore, it investigates if the quantitative index method BRIC for measuring community resilience could provide relevant information for municipalities' work with the two legislations LSO and LEH, and if there is a need for adapting the method for the Swedish context. The research questions were studied with the help of a selection of literature relevant for the subject, a questionnaire sent out to professionals' working with LSO and LEH and interviews.

The conducted research indicates that the concept resilience does add new perspectives for managing accidents and crisis. Some new perspectives that the concept entails are a more flexible and adaptable approach, which are to some extent missing from the organisations. Also, the questionnaire showed that professionals working with LEH integrate resilience into their work to a greater extent than those working with LSO. Moreover, there were some ambiguity in the free text responses in whether resilience provides new perspectives, or if the concept is a new name for already implemented methods.

Furthermore, the BRIC method could potentially complement the work for prevention, preparedness and response planning for accidents and crises. The included indicators in this thesis are selected with the help of a selection of literature which is specifically chosen to understand both the indicators in BRIC and also to understand if the indicators are suitable for the Swedish context. Also, most of the indicators included in the questionnaire received a high response rate, and it is therefore fair to assume that most indicators could be valuable in the respondents' professional role. Moreover, the rating of the indicators included in the questionnaire are similar among respondents working with LSO and LEH, and among respondents who work in municipalities of various sizes. It is therefore difficult to draw conclusions about which indicators that are more suitable for managing accidents or crises, or about the differences with regards to municipality size.

This thesis does however not result in a complete set of indicators that are suitable for the Swedish context. A future set of indicators for the Swedish context should be adapted with the help of professionals within the DRM field. The data for all indicators should also be easily accessible for the method to be easy to use. Furthermore, the chosen indicators should be regularly overviewed and adapted over time with regards to the constantly changing context. Finally, this area of research should be further investigated to be certain that the chosen categories and indicators provide relevant information and facilitates the work with prevention, preparedness and response planning for accidents and crises.

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Appendix 1 – The original BRIC

This appendix presents the BRIC method with all original categories and indicators as well as the how the indicators are measured. Table 5 is copied from Cutter, et al. (2014, pp. 69-70).

Table 5. The original indicators in BRIC.

Subdomain	Aspect and indicator
Social resilience	Educational attainment equality – Negative absolute difference between % population with collage education and % population with less than high school diploma
	Pre-retirement age – % Population below 65 years of age
	Transportation – % Households with at least one vehicle
	Communication capacity – % Households with telephone service available
	English language competency – % Population proficient English speakers
	Non-special needs – % Population without sensory, physical, or mental disability
	Health insurance – % Population under age 65 with health insurance
	Mental health support – Psychosocial support facilities per 10,000 persons
	Food provision capacity – Food security rate
	Physician access – Physicians per 10,000 persons
Economic resilience	Homeownership – % Owner-occupied housing units
	Employment rate – % Labour force employed
	Race/ethnicity income quality – Negative Gini coefficient
	Non-dependence on primary/tourism sectors – % Employees not in farming, fishing, forestry, extractive industry, or tourism
	Gender income equality – Negative absolute difference between male and female median income
	Business size – Ratio of large to small businesses

	Large retail-regional/national geographic distribution – Large retail stores per 10,000 persons
	Federal employment – % Labour force employed by federal government
Community capital	Place attachment-not recent immigrants – % Population not foreign-born persons who came to US within previous five years
	Place attachment-native born residents – % Population born in state of current residence
	Political engagement – % Voting age population participating in presidential election
	Social capital-religious organizations – Persons affiliated with a religious organization per 10,000 persons
	Social capital-civic organizations – Civic organizations per 10,000 persons
	Social capital-disaster volunteerism – Red cross volunteers per 10,000 persons
	Citizen disaster preparedness and response skills – Red cross training workshop participants per 10,000 persons
Institutional resilience	Mitigation spending – Ten-year average per capita spending for mitigation projects
	Flood insurance coverage – % Housing units covered by National Flood Insurance Program
	Jurisdictional coordination – Governments and special districts per 10,000 persons
	Disaster aid experience – Presidential disaster declarations divided by number of loss-causing hazard events from 2000 to 2009
	Local disaster training – % Population in communities with Citizen Corps program
	Performance regimes-state capital – Proximity of county seat to state capital
	Performance regimes-nearest metro area – Proximity of county seat to nearest county seat within a Metropolitan Statistical Area

	Population stability – Population change over previous five-year period
	Nuclear plant accident planning – % Population within 10 miles of nuclear power plant
	Crop insurance coverage – Crop insurance policies per square mile
Housing /Infrastructural resilience	Sturdier housing types – % Housing units not manufactured homes
	Temporary housing availability – % Vacant units that are for rent
	Medical care capacity – Hospital beds per 10,000 persons
	Evacuation routes – Major road egress points per 10,000 persons
	Housing stock construction quality – % Housing units built prior to 1970 or after 2000
	Temporary shelter availability – Hotels/motels per 10,000 persons
	School restoration potential – Public schools per 10,000 persons
	Industrial re-supply potential – Rail miles per square mile
	High speed internet infrastructure – % Population with access to broadband internet service
Environmental resilience	Local food suppliers – Farms marketing products through Community Supported Agriculture per 10,000 persons
	Natural flood buffers – % Land in wetlands
	Efficient energy use – Megawatt hours per energy consumer
	Pervious surfaces – Average percent perviousness
	Efficient Water Use – Inverted water supply stress index

Appendix 2 – Questionnaire

Welcome to this survey about community resilience

This questionnaire aims to collect data for a master thesis that Dalia Khairallah is writing for Lund University. The questionnaire turns to people within the emergency rescue services and/or municipal employees working with safety and crisis management issues. This thesis analyses a quantitative method for measuring community resilience on a sub-municipal level. Measurement of resilience on a sub-municipal level could facilitate the allocation of limited resources within the work of preventing and preparing for accidents and crisis.

If you have any question or if you want to know more about this project, contact Dalia Khairallah.

Page 1 in Survey Monkey

Explanation of questionnaire

The idea of the questionnaire is to investigate which knowledge gaps may be present within the work of preventive, preparedness and response planning. Further, the questionnaire aims to introduce the index method Baseline Resilience Indicators for Communities (BRIC) and to get an idea of the methods' relevance to the professional role that the respondent represents.

BRIC is a quantitative index method for measuring community resilience. The method uses statistically measurable variables (indicators) that aims to reflect an aspect of community resilience. More information about the method and the indicators later on in the survey.

What is resilience then? There is no unified definition of the concept, and I have therefore in this thesis chosen the same definition used in the BRIC method, which is:

“Resilience is defined as the societies ability to respond and recover from impacts and also adapt by re-organizing, changing and learning from past events to better manage future events (Cutter, et al. 2008, p. 599 – 600).”

Page 2 in Survey Monkey

Who you are and your experiences

The following questions aims to find out where you work and what your main tasks are. Further, this section aims to get an idea of what professionals in this field think of the concept resilience and whether measuring resilience could facilitate the work with preventive, preparedness and response planning for accidents and crisis.

1. Where do you work?
 - Emergency rescue services
 - Other municipal administration

2. How big is the population in the municipalities which you work in? You can choose several options.
 - Big municipality (100 000 inhabitants or more).
 - Medium-sized municipality (More than 40 000, but less than 100 000 inhabitants).
 - Smaller municipality (More than 15 000, but less than 40 000 inhabitants).
 - Small municipality (15 000 inhabitants or less).

3. What legislation do you work with? You can choose one or several options.
 - LSO
 - LEH

4. Have you been involved in developing the municipal RVA and/or the municipal action plan?
 - Yes, I have worked with the municipal RVA.
 - Yes, I have worked with the municipal action plan.
 - Yes, I have worked with both the municipal RVA and action plan.
 - No, I have not worked with either.

5. Do you work with preventive and mitigation planning¹⁶, response planning¹⁷ or operative? You can choose several options.
 - I work mainly or only with preventive and mitigation planning.

¹⁶ Förebyggande arbete

¹⁷ Insatsplanering

- I work mainly or only with response planning.
- I work mainly or only operatively.
- I have other main areas of responsibility.

If you have other main areas or responsibility, specify which in free text.

6. How familiar are you with the concept resilience?

- I am familiar with the concept and have integrated it in my work.
- I am familiar with the concept but have not integrated in in my work.
- I am not familiar with the concept.

7. Resilience is as mentioned:

“societies ability to respond and recover from impacts and also adapt by re-organizing, changing and learning from past events to better manage future events”.

Given that resilience can be measured, do you think that the concept adds new perspectives in the work for preventive, preparedness and response planning for accidents and crisis?

- The concept adds new perspectives that is not fully applied within the work for preventive, preparedness and response planning for accidents and crisis.
- The concept does not entail any new perspective.
- I do not have an opinion/I do not know.

8. What new perspective do you think resilience adds on for the work in preventive, preparedness and response planning for accidents and crisis? Skip this question if you replied “The concept does not entail any new perspective” or “I do not have an opinion/I do not know” on question 7.

Enter your answer in free text.

What is BRIC?

Baseline Resilience Indicators for Communities (BRIC) is, as previously mentioned, a quantitative index method for measuring community resilience.

In the index method BRIC, there are 6 different categories, each category measures a part of community resilience: social, economic, community capital, institutional, infrastructural and environmental. Within all 6 categories, there are various statistically measurable indicators that reflects an aspect of resilience within that category. The purpose of the indicators is to measure various aspects of community resilience within a predetermined geographical area. Therefore, it is important that each indicator can have an impact within a geographical area, i.e., indicators, for example, should not reflect on aspects with a national impact. Each indicator is given a value that should reflect the resilience of each aspect. By summing the value of all indicators, the general community resilience score of the geographical area is obtained, as well as resilience score within each category.

In this way, you can compare different geographical areas with each other, but also analyse which categories and indicators contribute to the high/low resilience of the geographical area. These measurements can in turn form the basis for, for example, distribution of resources, planning of preventive/preparedness measures.

The purpose with indicators

BRIC is developed and adapted for the context in the USA and the available data available in the country. In this thesis, these indicators have been both adapted for the Swedish context, but also limited to 23 (instead of the original 49). However, no change has been made regarding the 6 categories.

In the following part of the questionnaire, all 6 categories are presented as well as the purpose with each category. The indicators are presented under the category to which they belong and whether they contribute to increasing or decreasing resilience through the markings: (+) increased resilience and (-) decreased resilience.

The purpose of indicators is that they should reflect an aspect of community resilience within each category.

Example

Aspect: Voting participation in a municipality (+).

Indicator: Proportion of the population participating in parliamentary elections (%).

Reflects how politically committed a population is, the democracy in the community and indicates the trust and confidence that exists for the state and authorities. The marking (+) means that the indicator contributes to increased resilience.

Your task is to tick the indicators you believe adds knowledge and/or understanding that can be valuable in your professional role.

9. Social resilience

The social resilience category aims to capture demographic attributes in the community that would contribute to resilience. Communities that contribute to the well-being on their population are assumed to strengthen the individual ability to prepare and respond to different events.

Tick the indicators that you believe add knowledge and/or understanding that can be valuable in your professional role.

You can select several options.

- Education attainment (+) – Percent of population with at least a high school diploma (%).
- Income level (+) – Percentage of population with average or higher income level (%).
- Working age (+) – Percent of population between ages 15 – 67 (%).
- Swedish language competence (–) – Percent of population that has been enrolled on the SFI course during the past 5 years (%).
- Non-special needs (–) – Percent of population that are not dependent on special assistance (elderly care, personal assistance, LSS) (%).
- Health services (+) – Number of medical care staff per capita.

10. Do you think there are additional indicators that contribute to the measurement of social resilience? Regard the purpose of the category and the proposals should be easy to measure,

i.e., quantifiable, as well as general for a variety of threats/events.

Enter your answer in free text.

11. Economic resilience

Economic resilience measures the community assets and equal the distribution of resources. This category aims to measure the community's economy and not the individuals. The economy of the community can indicate how well a community can prepare and recover from an occurred event.

Tick the indicators that you believe add knowledge and/or understanding that can be valuable in your professional role.

You can select several options.

- Employment rate (+) – Percent of population with an employment (%).
- Income equality (+) – Income difference between men and women (%).
- Single sector business (–) – Number of employments in same industry per capita.
- Public tax-financed employment (+) – Number public tax-financed employments per capita.

12. Do you think there are additional indicators that contribute to the measurement of economic resilience? Regard the purpose of the category and the proposals should be easy to measure, i.e., quantifiable, as well as general for a variety of threats/events.

Enter your answer in free text.

13. Community capital

Community capital aims to reflect the engagement of the population in the community. Engagement in the community could indicate social networks that can benefit the response and recovery during and after an occurred event.

Tick the indicators that you believe add knowledge and/or understanding that can be valuable in your professional role.

You can select several options.

- Voting participation (+) – Percent of population that votes in the general election (%).
- Community involvement (+) – Percent of population involved in various leisure activities (religious, sport, cultural) (%).
- Social capital disaster volunteers (+) – Percent of population that are active in FRG (%).

14. Do you think there are additional indicators that contribute to the measurement of community capital? Regard the purpose of the category and the proposals should be easy to measure, i.e., quantifiable, as well as general for a variety of threats/events.

Enter your answer in free text.

15. Institutional resilience

The institutional resilience domain aims to capture aspects related to community governance and crisis management.

Tick the indicators that you believe add knowledge and/or understanding that can be valuable in your professional role.

You can select several options.

- Average per capita spending on mitigation and prevention projects (+) – Amount spent on mitigation and preparedness measure (SEK).
- Disaster experience (+) – Number of events that municipality have applied for state compensation according 7 Chapter 3§ LSO (2003:778) and/or 5 Chapter 1§ LEH (2006:544).
- Closeness to emergency service (+) – Mean distance to emergency services (police, fire rescue service, ambulance).
- Population stability (+/-) – Absolute in/out migration as percentage of population (%).

16. Do you think there are additional indicators that contribute to the measurement of institutional resilience? Regard the purpose of the category and the proposals should be easy to measure, i.e., quantifiable, as well as general for a variety of threats/events.

Enter your answer in free text.

17. Infrastructural resilience

This category aims to indicate how well a society can respond and recover from crisis. The category also provides an indication of how vulnerable infrastructures could be to various crises.

Tick the indicators that you believe add knowledge and/or understanding that can be valuable in your professional role.

You can select several options.

- Temporary shelter possibility (+) – Number of hotel/motels per capita.
- Schools (+) – Number of schools per capita.
- Re-supply potential (+) – Mean distance to train stations, airports, ports, major roads (km).
- Communication capacity (+) – Percent of population with a smartphone (%).

18. Do you think there are additional indicators that contribute to the measurement of infrastructural resilience? Regard the purpose of the category and the proposals should be easy to measure, i.e., quantifiable, as well as general for a variety of threats/events.

Enter your answer in free text.

19. Environmental resilience

The environmental resilience domain aims to capture the capacities to serve as a resource or buffer against environmental threats.

Tick the indicators that you believe add knowledge and/or understanding that can be valuable in your professional role.

You can select several options.

- Natural flood buffer (+) – Area wetland (%).
- Pervious surfaces (+) – Area permeable land (%).

20. Do you think there are additional indicators that contribute to the measurement of environmental resilience? Regard the purpose of the category and the proposals should be easy to measure, i.e., quantifiable, as well as general for a variety of threats/events.

Enter your answer in free text.

21. Are there any other aspects that you consider to be missing but that are not suitable to include in any of the 6 categories: social, economic, community capital, institutional, infrastructure and environment? Keep in mind that the proposals should be easy to measure, i.e., quantifiable, as well as general for a variety of threats/events.

Enter your answer in free text.

22. Do you have anything else you would like to share?

Enter your answer in free text.

Page 5 in Survey Monkey

Thank you for your participation

If you have any more questions or are curious for more information about this project, you are welcome to contact Dalia Khairallah.

Page 6 in Survey Monkey

Appendix 3 – Results from questionnaire

Presented in this appendix are the results from the questionnaire.

Response Q1

Table 6. The distribution of where the respondents work.

Emergency rescue service	Other municipal administration
16/34 respondents	18/34 respondents
47 %	53 %

Response Q2

Table 7. The distribution of the size of the municipality where the respondents work.

> 100 000 ppl	40 000 < ppl < 100 000	15 000 < ppl < 40 000	< 15 000 ppl
11/34 respondents	7/34 respondents	12/34 respondents	4/34 respondents
32 %	21 %	35 %	12 %

Response Q3

Table 8. The distribution of what legislation the respondents work with.

LSO	LEH	Both legislations
10/34 respondents	20/34 respondents	4/34 respondents
29 %	59 %	12 %

Response Q4

Table 9. The distribution and number of respondents that have worked with municipal RVA and action plans.

	Number of respondents	%
Yes, I have worked with the municipal RVA.	17/34 respondents	50 %
Yes, I have worked with the municipal action plan.	3/34 respondents	9 %
Yes, I have worked with both the municipal RVA and action plan.	11/34 respondents	32 %
No, I have not worked with either.	3/34 respondents	9 %

Response Q5

Table 10. The respondent's main areas of responsibilities.

	Number of respondents	%
I work mainly or only with preventive and mitigation planning.	22/34 respondents	65 %

I work mainly or only with response planning.	6/34 respondents	18 %
I work mainly or only operatively.	8/34 respondents	24 %
I have other main areas of responsibility.	12/34 respondents	35 %

Free text answers:

- Managerial issues.
- Operations management for emergency services, strategic and systematic security work as well as crisis preparedness coordination and security protection.
- Budget, personnel, business planning, municipal management, crime prevention, public health issues.
- Do not work at all with LSO.
- Mainly strategic work with contingency and civil defence planning.
- Management of emergency rescue services.
- Crisis preparedness issues - primarily with planning/prevention but also crisis management when an even has occurred.
- Security issues, crime prevention work.
- Overall governance issues at municipal and regional level.
- Crisis preparedness, civil defence, signalling protection, crime prevention, security, safety.
- Operational strategist with overall projects, development, investigations, etc. Also included in the contingency as the highest responsible for the system management in Skåne NV.
- Also works operationally and with urban planning, building permits, etc.
- Crisis preparedness and management. Management of operational security incidents.

Response Q6

Table 11. Distribution of respondents that are either familiar or not with the resilience concept.

	Number of respondents	%
I am familiar with the concept and have integrated it in my work.	15/34 respondents	44 %
I am familiar with the concept but have not integrated in in my work.	15/34 respondents	44 %
I am not familiar with the concept.	4/34 respondents	12 %

Table 12 and 13 presents the distribution of respondents with regards to the legislation they work with as well as the size of the municipality they work in.

Table 12. Distribution of respondents with regards to the legislation they work with.

	LSO	%	LEH	%	TOT
I am familiar with the concept and have integrated it in my work.	4	29 %	14	58%	15
I am familiar with the concept but have not integrated in in my work.	7	50 %	9	38%	15
I am not familiar with the concept.	3	21 %	1	4%	4
TOT	14	100 %	24	100 %	34

Note that some of the respondents work with both LSO and LEH.

Table 13. Distribution of respondents with regards the size of the municipality they work in.

	Very large	%	Large	%	Medium	%	Small	%	TOT
I am familiar with the concept and have integrated it in my work.	6	55%	4	57%	4	33%	1	25%	15
I am familiar with the concept but have not integrated in in my work.	4	36%	2	29%	7	58%	2	50%	15
I am not familiar with the concept.	1	9%	1	14%	1	8%	1	25%	4
TOT	11	100%	7	100%	12	100%	4	100%	34

Response Q7

Table 14. Distribution of responses on whether resilience adds new perspective of not in the work done.

	Number of respondents	%

The concept adds new perspectives that is not fully applied within the work for preventive, preparedness and response planning for accidents and crisis.	24/33 answers	73 %
The concept does not entail any new perspective.	2/33 answers	6 %
I do not have an opinion/I do not know.	7/33 answers	21 %

Table 15 and 16 presents the distribution of respondents with regards to the legislation they work with as well as the size of the municipality they work in.

Table 15. Distribution of respondents with regards to the legislation they work with.

	LSO	%	LEH	%	TOT
The concept adds new perspectives that is not fully applied within the work for preventive, preparedness and response planning for accidents and crisis.	9	64%	18	78%	24
The concept does not entail any new perspective.	1	7%	1	4%	2
I do not have an opinion/I do not know.	4	29%	4	17%	7
TOT	14	100%	23	100%	33

Note that some of the respondents work with both LSO and LEH.

Table 16. Distribution of respondents with regards the size of the municipality they work in.

	Very large	%	Large	%	Medium	%	Small	%	TOT
The concept adds new perspectives that is not fully applied within the work for preventive, preparedness and response planning for accidents and crisis.	9	82%	5	71%	8	73%	2	50%	24

The concept does not entail any new perspective.	0	0%	0	0%	1	9%	1	25%	2
I do not have an opinion/I do not know.	2	18%	2	29%	2	18%	1	25%	7
TOT	11	100%	7	100%	11	100%	4	100%	33

Response Q8

17 people skipped this question.

Free text answers:

- Our ability to reorganize and perhaps think outside the box. (LSO)
- Adds a more inclusive perspective, i.e., that the resilience aspects in crisis preparedness are regarded by several parts of the organisation. Creates added value for disruptions that are not covered by crisis preparedness/management. (LEH)
- Can be difficult to define because different parts of the municipal activities react differently and absorb information differently depending on their main task. A major problem has been getting municipalities to understand that they have worked with continuity and resilience more or less always, but it has only had different names and been part of the everyday planning that many have had. We need to work further on this and use such simple expressions and preferably practical applications so that the authorities and businesses can see it as part of what they already do without seeing it as an extra load to be performed outside of what they consider to be their main task. (LSO/LEH)
- Do not know.
- We have been preventing disturbances for many years, but there are constantly new challenges that we have not thought of before. (LSO/LEH)
- It is important to talk about rebuilding ability. (LEH)
- The concept provides an overall framework for the goal of contingency planning. (LEH)
- Good with new perspectives. (LEH)
- It forces one to think in other ways than just maintaining the goals and objectives that the municipality has set itself. Gets easier to work on the "how". (LSO)
- Yes, creates an opportunity for comparisons between businesses and internally within a business. (LEH)
- A business needs to be adaptable to be able to withstand different types of disruptions, to not only be prepared for one type of event but no matter what happens, to have an organization

- and readiness to be able to quickly adjust and manage to maintain its business. Also, to learn from events that have occurred and "bounce back better" and use those experiences to become better at managing different types of events, not just the one you have just been through. (LEH)
- My opinion is that the work today focuses a lot on returning to the "original state" - something that not least shows itself now during the pandemic. Resilience adds to reorganizing and adapting as a natural part of both preparatory and crisis management work. (LEH)
 - I do not always think that organisations work to (or talks about) returning to a better state but more often to the state that was before an event. (LEH)
 - This shows that flexibility is not constant but is adapted to the conditions. Plans are thus not the obvious solution, but an approach and an understanding of the context that enable flexibility to be achieved is required. I also believe that vulnerabilities can be actively accepted in a resilient society. It is less sensitive, more like part of the system. (LEH)
 - I believe that resiliens is primarily a concept that has a greater effect if it is integrated into other municipal areas of responsibility than LSO and LEH. (LEH)
 - An understanding has a redundancy can be created in case of disturbances in the systems. (LSO/LEH)
 - The concept provides a somewhat broader view of preparedness and an organization's "robustness" to handle unforeseen events. (LSO)

Response Q9 – Social resilience

14 people skipped this question.

The response rate for the indicators presented below the category social resilience are presented in Table 17.

Table 17. Response rate for all indicators presented under social resilience.

Subdomain	Aspect	Number of respondents	%
Social resilience	Educational attainment	16/20 answers	80 %
	Income level	11/20 answers	55 %
	Working age	10/20 answers	55 %
	Swedish language competency	10/20 answers	50 %
	Non-special needs	16/20 answers	80 %
	Health services	14/20 answers	70 %

Table 18 and 19 presents the distribution of respondents with regards to the legislation they work with as well as the size of the municipality they work in.

Table 18. Distribution of respondents with regards to the legislation they work with.

	LSO	%	LEH	%	TOT
Education level	7	88%	12	80%	16
Income level	5	63%	8	53%	11
Working age	5	63%	7	47%	10
Swedish language competence	5	63%	7	47%	10
Non-special needs	5	63%	13	87%	16
Health services	5	63%	12	80%	14
TOT number of respondents	8		15		20

Note that some of the respondents work with both LSO and LEH.

Table 19. Distribution of respondents with regards the size of the municipality they work in.

	Very large	%	Large	%	Medium	%	Small	%	TOT
Education level	7	100%	3	75%	5	71%	1	50%	16
Income level	7	100%	2	50%	1	14%	1	50%	11
Working age	4	57%	3	75%	2	29%	1	50%	10
Swedish language competence	4	57%	2	50%	2	29%	2	100%	10
Non-special needs	5	71%	3	75%	6	86%	2	100%	16
Health services	6	86%	2	50%	4	57%	2	100%	14
TOT number of respondents	7		4		7		2		20

Response Q10 – Social resilience

25 people skipped this question.

Free text answers:

- General awareness of how vulnerable society is so that the individual takes his own measures in his private life in order not to create extra strain on the authorities and societies rescue services. (LSO/LEH)
- What languages that occur in the municipality in addition to Swedish and English, in order to adapt so that everyone can take part in information.
- Percent of children in preschool. (LEH)
- No own points.
- Probably.
- Population trend - how much the population is expected to increase/decrease in the future and what ages are expected to increase (e.g., we get a much older population in the future, how does it affect society's ability to cope with an adverse event). (LEH)
- Child poverty, overcrowding, income support rates, sick leave rates, local trust (see indicator Malmö area survey (VAT)). (LEH)
- --
- Surly, but non I can think of.

Response Q11 – Economic resilience

14 people skipped this question.

The response rate for the indicators presented below the category economic resilience are presented in Table 20.

Table 20. Response rate for all indicators presented under economic resilience.

Subdomain	Aspect	Number of respondents	%
Economic resilience	Employment rate	19/20 answers	95 %
	Income equality	7/20 answers	35 %
	Single sector business	9/20 answers	45 %
	Public tax-financed employment	10/20 answers	50 %

Table 21 and 22 presents the distribution of respondents with regards to the legislation they work with as well as the size of the municipality they work in.

Table 21. Distribution of respondents with regards to the legislation they work with.

	LSO	%	LEH	%	TOT
Employment rate	8	100%	14	93%	19

Income equality	2	25%	5	33%	7
Single sector business	4	50%	8	53%	9
Public tax-financed employment	4	50%	7	47%	10
TOT number of respondents	8		15		20

Note that some of the respondents work with both LSO and LEH.

Table 22. Distribution of respondents with regards the size of the municipality they work in.

	Very large	%	Large	%	Medium	%	Small	%	TOT
Employment rate	7	100%	4	100%	7	100%	1	50%	19
Income equality	4	57%	1	25%	1	14%	1	50%	7
Single sector business	4	57%	1	25%	3	43%	1	50%	9
Public tax-financed employment	2	29%	2	50%	4	57%	2	100%	10
TOT number of respondents	7		4		7		2		20

Response Q12 – Economic resilience

26 people skipped this question.

Free text answers:

- Overview of domestic production in comparison with what we import or export, as well as what things that are produced in the country, maybe we need a governance similar to the old model for war activities. where the state had contracts with the business community. (LSO/LEH)
- Do not know.
- No own points.
- There are probably plenty.
- Proportion of residents living on financial aid. (LEH)

- % of income that goes to housing costs, loan-to-value ratio. (LEH)
- Surly, but non I can think of.

Response Q13 – Community capital

14 people skipped this question.

The response rate for the indicators presented below the category community capital are presented in Table 23.

Table 23. Response rate for all indicators presented under community capital.

Subdomain	Aspect	Number of respondents	%
Community capital	Political engagement	15/20 answers	75 %
	Community involvement	16/20 answers	80 %
	Social capital - disaster volunteerism	14/20 answers	70 %

Table 24 and 25 presents the distribution of respondents with regards to the legislation they work with as well as the size of the municipality they work in.

Table 24. Distribution of respondents with regards to the legislation they work with.

	LSO	%	LEH	%	TOT
Voting participation	5	63%	11	73%	15
Community involvement	6	75%	13	87%	16
Social capital disaster volunteers	6	75%	11	73%	14
TOT number of respondents	8		15		20

Note that some of the respondents work with both LSO and LEH.

Table 25. Distribution of respondents with regards the size of the municipality they work in.

	Very large	%	Large	%	Medium	%	Small	%	TOT
Voting participation	6	86%	4	100%	4	57%	1	50%	15
Community involvement	5	71%	2	50%	7	100%	2	100%	16

Social capital disaster volunteers	4	57%	3	75%	6	86%	1	50%	14
TOT number of respondents	7		4		7		2		20

Response Q14 – Community capital

25 people skipped this question.

Free text answers:

- Education for young people in school, law governs emergency education as we had it in the post-war period but adjust the education to adapt to the modern context. (LSO/LEH)
- No.
- The populations attitude of working as a part-time firefighter. (LSO)
- Not any I can think of.
- Number of visits to the municipality's website/social media. Voluntary groups - may be about non-governmental organizations other than FRG. (LEH)
- There are more voluntary defence organizations than FRG. Why not bring everyone? There are also several similar ones that may not fall under "defence care." but who do about the same thing. (LEH)
- Membership is not the modern form of commitment. Many get involved outside of traditional organisations... I also think that in cultures with great social interaction, a network is created that is not based on the form of association but on culture/language/religion/country of origin. It can also be advantageous in this context. (LEH)
- There should be, however, I do not think that the two "lower" proposals for indicator are indicators of this. (LSO)

Response Q15 – Institutional resilience

14 people skipped this question.

The response rate for the indicators presented below the category institutional resilience are presented in Table 26.

Table 26. Response rate for all indicators presented under institutional resilience.

Subdomain	Aspect	Number of respondents	%
Institutional resilience	Mitigation spending	16/20 answers	80 %
	Disaster aid experience	11/20 answers	55 %

	Closeness to emergency service	18/20 answers	90 %
	Population stability	5/20 answers	25 %

Table 27 and 28 presents the distribution of respondents with regards to the legislation they work with as well as the size of the municipality they work in.

Table 27. Distribution of respondents with regards to the legislation they work with.

	LSO	%	LEH	%	TOT
Average per capita spending on mitigation and prevention projects	8	100%	11	73%	16
Disaster aid experience	4	50%	9	60%	11
Closeness to emergency service	7	88%	13	87%	18
Population stability	2	25%	4	27%	5
TOT number of respondents	8		15		20

Note that some of the respondents work with both LSO and LEH.

Table 28. Distribution of respondents with regards the size of the municipality they work in.

	Very large	%	Large	%	Medium	%	Small	%	TOT
Average per capita spending on mitigation and prevention projects	5	71%	4	100%	5	71%	2	100%	16
Disaster aid experience	3	43%	2	50%	4	57%	2	100%	11
Closeness to emergency service	6	86%	3	75%	7	100%	2	100%	18
Population stability	1	14%	1	25%	2	29%	1	50%	5

TOT number of respondents	7		4		7		2		20
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Response Q16 – Institutional resilience

29 people skipped this question.

Free text answers:

- No.
- No own points.
- There are probably plenty.
- --
- I do not think that the examples above are sufficient to indicate what is desired. It is more about the municipality's ability to see, to adjust, to act, which I do not think is reflected in the proposals for indicators above. (LSO)

Response Q17 – Infrastructural resilience

16 people skipped this question.

The response rate for the indicators presented below the category infrastructural resilience are presented in Table 29. Only 18 of the 20 respondents for the second part of the questionnaire answered on the question about the indicators presented this category.

Table 29. Response rate for all indicators presented under infrastructural resilience.

Subdomain	Aspect	Number of respondents	%
Infrastructure/ Housing	Temporary shelter availability	9/18 answers	50 %
	School restoration potential	10/18 answers	55 %
	Industrial re-supply potential	13/18 answers	72 %
	Communication capacity	16/18 answers	89 %

Table 30 and 31 presents the distribution of respondents with regards to the legislation they work with as well as the size of the municipality they work in.

Table 30. Distribution of respondents with regards to the legislation they work with.

	LSO	%	LEH	%	TOT
Temporary shelter possibility	4	50%	7	47%	9
Schools	5	63%	7	47%	10

Re-supply potential	5	63%	10	67%	13
Communication capacity	7	88%	12	80%	16
TOT number of respondents	8		15		20

Note that some of the respondents work with both LSO and LEH.

Table 31. Distribution of respondents with regards the size of the municipality they work in.

	Very large	%	Large	%	Medium	%	Small	%	TOT
Temporary shelter possibility	2	29%	2	50%	4	57%	1	50%	9
Schools	3	43%	2	50%	3	43%	2	100%	10
Re-supply potential	3	43%	4	100%	4	57%	2	100%	13
Communication capacity	5	71%	3	75%	6	86%	2	100%	16
TOT number of respondents	7		4		7		2		20

Response Q18 – Infrastructural resilience

27 people skipped this question.

Free text answers:

- No.
- Percent of population with access to own water. Access to alternative drinking water sources? Proportion of the population with access to their own heating of housing (fireplace, etc). (LSO)
- Probably.
- Proportion of the population with access to radio (for communication in the event of an interruption in the telecommunications infrastructure). Proportion who travels in/out of the municipality every day for work (how many residents in the municipality also work in the municipality, can be significant if transport infrastructure is disrupted). (LEH)
- Maybe it should not be access to a smartphone but to the internet. (LEH)
- I don't really see that the indicators above correspond to what is desired to be "measured". (LSO)

Response Q19 – Environmental resilience

16 people skipped this question.

The response rate for the indicators presented below the category environmental resilience are presented in Table 32. Only 18 of the 20 respondents for the second part of the questionnaire answered on the question about the indicators presented this category.

Table 32. Response rate for all indicators presented under environmental resilience.

Subdomain	Aspect	Number of respondents	%
Environmental resilience	Natural flood buffer	16/18 answers	89 %
	Pervious surfaces	12/18 answers	67 %

Table 33 and 34 presents the distribution of respondents with regards to the legislation they work with as well as the size of the municipality they work in.

Table 33. Distribution of respondents with regards to the legislation they work with.

	LSO	%	LEH	%	TOT
Natural flood buffer	7	88%	12	80%	16
Pervious surfaces	5	63%	9	60%	12
TOT number of respondents	8		15		20

Note that some of the respondents work with both LSO and LEH.

Table 34. Distribution of respondents with regards the size of the municipality they work in.

	Very large	%	Large	%	Medium	%	Small	%	TOT
Natural flood buffer	5	71%	3	75%	6	86%	2	100%	16
Pervious surfaces	6	86%	2	50%	3	43%	1	50%	12
TOT number of respondents	7		4		7		2		20

Response Q20 – Environmental resilience

Free text answers:

- No.
- No own points.
- Sea levels and ground levels. (LSO)
- Forest composition could be one, i.e., thinks that there are other threats than just floods that can give. (LSO)
- Proportion of forest land. Buildings in coastal areas. (LEH)
- --
- The proposals above only reflect the resilience in the event of floods. Lacks indicators for other environmental impact. (LSO)

Response Q21

29 people skipped this question.

Free text answers:

- No.
- Sure, but not here.
- Something linked to management capabilities. For example, people in crisis management who are trained and educated. (LEH)
- No.

Response Q22

28 people skipped this question.

Free text answers:

- No.
- Exciting work! This is really important.
- Not sure how the indicators alone will be able to measure resilience. Resilience consists of so much more than measurable factors, such as collaborations/coordination between public and private actors and voluntary organizations, and how plans and measures are implemented in activities. The indicators presented here can be a good starting point, but I think you have to look at the whole to be able to say something about how resilient a society is. (LEH)
- All indicators should have some form of evidence that they are relevant. The risk when we start using quantitative methods is that what cannot be measured as easily is left out. Not because it does not have an effect, but because it is not already measured. I think it is difficult to find such measuring instruments that become relevant. Suggest that you look at Agenda 2030 where work has already been done to find indicators for measuring goal fulfilment. (LEH)
- No.

Appendix 4 – Interviews

This appendix presents a detailed summary of the conducted interviews.

Interview 1

The interviewee work with solely LSO in an emergency rescue service in a small municipality. Some of the interviewee's main areas of responsibilities are accident prevention, but the interviewee also work operatively.

The interview started with a quick summary of the questionnaire, so the interviewee would understand the content of the interview. Furthermore, the interviewee was asked why resilience would not contribute to new perspectives in their work and also how the emergency rescue service work with resilience. According to the interviewee, the emergency rescue service already work a lot with resilience thinking and that they are very good at preparing for unexpected events. However, in the opinion of the interviewee, other departments within the municipality are not very prepared for unexpected events. Moreover, the interviewee was asked if the emergency rescue service is good at learning from past events and therefore better adapt for future events. The response was that their organisation can certainly improve their learning and adaptation for future events. Though, the emergency rescue service was according to the interviewee better than other departments within the municipality at learning for future events.

This interviewee was one of the respondents that did not fill in the part of the questionnaire that introduced the BRIC method. Also, the respondent did not remember the questionnaire completely. Because of this, the interviewer went through what the BRIC method is and also showed the interviewee the 23 included indicators. When seeing the 23 indicators, the interviewee was surprised that this part of the questionnaire was skipped but also emphasized that their emergency rescue service is responsible for a small municipality with a small population. There is knowledge about the population within in their organisation because the municipality is small according to the interviewee. However, this knowledge is often based on internal rumours. The interviewer asked if could be beneficial if there was a quantitative method to confirm or dismiss these rumours, and the response was that it could perhaps be good because of the objectivity of the method. Furthermore, the interviewee also said that larger municipalities could have a greater need of a quantitative method for measuring community resilience.

Interview 2

The interviewee work with solely LEH in a municipal administration in a large municipality. Some of the interviewee's main areas of responsibilities are preparedness planning for crises.

The interview started with a quick summary of the questionnaire, so the interviewee would understand the content of the interview. The interviewer asked how the resilience concept did entail new perspectives that was not fully applied within the work done, and more specifically how there needed to be better adaptation capacity and flexibility as well as learning from past events. The interviewee responded that their organisation work with scenario analysis and whether there are capacities to manage those specific scenarios. However, most often the occurred events are not identical to the practiced scenarios and there needs to better flexibility and adaptation to the occurred event, even though the scenario analysis is also a good tool. Furthermore, the interviewee said that learning was important for understanding what functioned or did not function during past crises and therefore adapt better for future events. However, the interviewee could not say how learning was applied within their organisation because this person was fairly new to the job.

This interviewee did fill in the part of the questionnaire where the indicators were presented and was therefore asked some questions about some of the free text responses. The interviewer began with retelling what response that was given during the questionnaire. Which was “Considerations has to be taken to collaboration and coordination among different stakeholders and the presented method can therefore not measure all aspects of resilience”. Furthermore, the interviewer asked if the method could be a complement to the work done. The interviewee responded that the method does not measure the holistic perspective that resiliens entails. However, the method could be beneficial to use when mapping an overview of the population in the municipal RVA. Furthermore, the interviewee responded that the method could potentially complement the work done.