Evaluating the Team Resilience Assessment Method for Simulation (TRAMS)

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Abstract

The Team Resilience Assessment Method for Simulation (TRAMS) is an instrument that consist of several measurements, such as team-member exchange, workload, the TRAMS observation protocol etc. This thesis researches the observation protocol. The TRAMS protocol is an assessment method for resilience in simulation games. The aim of this protocol is to support the identification of resilience strategies used and developed by the participants in a simulation game. It is a challenge to assess resilience in teams and that is why the TRAMS protocol has been developed. The scenario of the simulation games is a disruption for 10 days in the card payment system. During the simulation games, the participants work in teams and have to try to cope with the disruption in the card payment system. During the course of this study, 14 simulation games have been conducted with seven different teams. Each of the simulation games has been executed during one whole day, and the participating teams have in total played two games each. During every simulation game there were three observers equipped with the TRAMS protocol. To interpret the data collected with the TRAMS protocol, two methods have been used: transcription and thematic analysis. As a result, guidelines and design changes was formed. In addition, results showed that the distribution and frequency of observations of resilience strategies made were similar, that the observations noted by the observers were similar, and lastly eight themes from the data collection could be extracted: Coordinate and collaborate, Payment options, Cash circulation, Safety, Fuel and transportation, Inform, communicate and the media, Hoarding and rationing, Vulnerable groups. In conclusion, the TRAMS protocol is still under development and 15 more simulation games are planned to be conducted within the ongoing CCRAAAFFTING project. However, the protocol has been applied in this study’s 14 simulation games so far, and the similarities in how the observers filled in the protocol and how similar the observations were, indicate that it hopefully can develop into a recognized research tool in the future.

Keywords: Team resilience, simulation games, assessment, training, Systemic Resilience Model
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1 Introduction

Electronic payments, such as card payments, are becoming more common and at the same time cash payment are less common. Up to 80 percent of people use card payments, unlike in 2016 when 64 percent used them. In 2018, 13 percent of payments were cash, and 7 percent were credit-cards (Sveriges Riksbank, 2018). So, imagine the dire consequences that would arise when an important infrastructure, such as card payments, stopped working. This affects both individuals, but also important parts of society. In Sweden, almost all payments are made with card and in fact, many shops even refuse to accept cash nowadays. Most people do not have any precautions or even thoughts of a breakdown in the card payment system. In addition, the amount of money currently available in ATMs would not be sufficient to support nor cover citizens’ expenses in a situation where everything needs to be paid with cash. Therefore, it is important to create awareness about society’s vulnerability to these risks and to try to identify how to build a defence against disruptions. On the other hand, this is hard to do since these systems are complex as well as hard to analyse, which is why they need a balance between disruption, prevention and recovery (Laere et al., 2017). In addition, one of the most important infrastructures in today’s society is the payment system. If that stops working, it could, in turn, affect other critical systems such as security services, transportation, food and agriculture etc. Therefore, it is interesting and important to conduct research on how payment systems can manage crises and become more resilient. By developing a collective resilience, i.e. the ability to recover or resist different disturbances in complex dynamic systems, as well as analysing and creating awareness of it, crises could be managed better. However, currently there is a lack of assessment approaches for evaluation of resilient capabilities in simulation games according to Johansson, Laere, & Berggren (2018). We cannot verify that training and practice has been good and useful way if we cannot evaluate collective resilience.

In a project called Creating Collaborative Resilience Awareness, Analysis and Action for Finance, Food and Fuel System in INteractive Games (CCRAAAFFTING), the issue of how society handles disruptions and how resilience in crisis response teams can be assessed are addressed. The project is commissioned by the Swedish Civil Contingencies Agency (MSB) and is a five-year project with the aim of developing a simulation-gaming environment (combining table top role-playing exercises with computer simulation) to create a context, in which the payment system is represented and where dependencies between different actors in the food, fuel, and financial domains become observable. This approach can be used to better
understand disruptions in the payment system, such as card payments, and how resilience is achieved and maintained (Laere et al., 2017). There are four actors involved in this project: University of Skövde, who is the project leader and has expertise in role playing for crisis management; University of Linköping, who have expertise in resilience and evaluation of exercises; Mid Sweden University, who have expertise in simulation of complex systems; and, finally, Combitech AB who have expertise in crisis management exercises, primarily at municipal and regional level.

The CCRAAAAFFTING project started in 2016. Initial data collections based on document studies, interviews and workshops with experts from the food, fuel and financial sectors revealed challenges for collective cross-functional critical infrastructure resilience (Laere et al., 2017). In total, there will be 30 simulation games with role-playing performed in the project; as of now 14 simulation games have been completed. The results from these game sessions will be evaluated both with qualitative and quantitative methods in this thesis. Measurements like team-member exchange (TMX), workload and shared priorities are collected in the study. From these evaluations, the identified collective action strategies and their impact are summed up.

In the long-run this project will provide team-training to decision-makers in handling crisis situations in a multi-organisational context. To be able for an individual or a group of actors to be able to experience the dynamics of a real-world problem, gaming-simulation can be used (Laere, De Vreede, & Sol, 2006). A more detailed description of the development and design of crisis response simulation and scenarios can be found in (Laere et al., 2017).

Moreover, the benefit to society of the CCRAAAAFFTING project is that it will hopefully create insight into how interruption in payment systems affects different actors. Additionally, it can create awareness among the actors about what different collective actions exist and what effects these action strategies have on an individual level and on Swedish society as a whole. This could probably increase resilience in Swedish society when interruptions in payment systems happen.

The Team Resilience Assessment Method for Simulation (TRAMS) is an instrument that consist of several measurements, such as team-member exchange, workload TRAMS protocol etc. The aim with TRAMS is to measure team resilience in crisis management. However, this thesis is mainly about the TRAMS protocol, which is an observation protocol. This protocol is
based on resilience theory, in which strategies about how the teams in the simulation games manage disruption are observed. For future data collection, this protocol can be used to observe what resilience strategies a team develops, but there is still a possibility that further improvements are needed. This thesis contributes to the CCRAAAFFTING project by creating guidelines and improving the design of the TRAMS protocol, but also to see if the teams become more resilient or are more resilient.

1.1 Purpose
The purpose of this study is to evaluate the Team Resilience Assessment Method for Simulation (TRAMS), which is a protocol that is based on the systemic resilience model (Johansson et al., 2018). To evaluate this protocol, 14 simulation games will be conducted, and data will be analysed to collect knowledge about how the design can be improved and to create some guidelines in how to use it in the future data collections, what themes that could be found in the data, how similar the observers have observed, and in which way the observers filled in the TRAMS protocol.

1.2 Limitation
The limitations of this project are that it is a simulation within the frames of the CCRAAAFFTING project. At the same time, there are stake-holders from relevant organizations and authorities that participate in the simulation games. Another limitation is that there was only time to do 14 simulation games for this thesis, but it is still a high enough number of data collection to draw conclusions about the protocol. In addition, this thesis focus only on the observation protocol and not the other measurements (team-member exchange (TMX), workload and shared priorities) used in this project.

1.3 Research questions
- How similar are the distribution of observed resilience strategies noted by the observers?
- What strategies from the TRAMS protocol were found during the data collections?
- What themes within the strategies noted when using the observation protocol could be found?
- Are similar observations made between the observers?
- How can the design of the TRAMS protocol be improved?
• What guidelines are needed to help the observers use the TRAMS protocol in the same way?
2 Theoretical background

The purpose of this chapter is to explain the theoretical concepts this study is based on. What is addressed in this section are socio-technical systems, resilience, team, simulation game, role playing and observation protocol.

2.1 Resilience in socio-technical systems

Before we dive into the term resilience, a system, or more specifically in this thesis, a socio-technical system (STS) needs to be explained. Originally, the term socio-technical system was coined by Trist, Bamforth and Emery in the 1950s (Waterson et al., 2015; Hollnagel, Robert, & Braithwaite, 2015). They studied the relationships between workers and technology in the English coal mines. The main motivation for STS was to see the interaction between people (the social system) and technologies (the technical system), and to emphasise the role of choice and organisational design (Waterson et al., 2015). According to Waterson et al. (2015), the core value is in the STS approach that the right choices, social systems and technical systems can be balanced so that productivity, safety, and worker satisfaction can be optimised in parallel. In short, society itself, and its organisations and institutions, is a complex STS (Hollnagel et al., 2015). According to Waterson et al. (2015), STS have influenced several domains within human factors and ergonomics. There is also an increased interest in understanding the underlying causes of failure of complex STS, such as accidents like Chernobyl. In addition, the focus has shifted away from only individual errors, towards a better understanding of safety management, specifically the terms safety culture and climate. In turn, this requires an understanding of the interconnectivity and increased complexity between systems and their elements. In the future, proactive safety or in other words “resilience” is needed to deal with this, and how resilience can be achieved. In addition, it is needed to deal with how organisations can make trade-offs while still considering safety when there are other issues, such as system reliability, security, productivity and product cost (Waterson et al., 2015).

Socio-technical systems try to achieve one or several safety goals when the system or the goals have potential threats against them. The system should protect these critical safety goals, and the system under pressure should be flexible with the goals. However, the system should always protect the core goals. These goals are what the system holds as most central. In order for the system not to abandon its core goals in crisis situations, it is required that the system is resilient (Lundberg & Johansson, 2015).
2.2 The development of systemic resilience

Many interpret the focus of safety management as assuring the absence of unwanted outcomes such as disruptions, incidents or accidents; in other words, that “nothing should go wrong”. Generally speaking, safety is defined as the system quality of handling a number of events that can be harmful to people, society and environment and these events should be acceptably low. This point of view is called Safety-I. We cannot ensure things to go well by preventing things from going wrong, which is the foundation of Safety-I. The Safety-I view of safety management was developed in the 1960-1980 when performance demands were much lower, simpler, and less interdependent than today, and since then they have become more complex, uncertain and intractable. The Safety-I approach to “find and fix” the unwanted event is not enough. Also, the systems’ performance often needs to adjust for the system to function when conditions are underspecified, or when time or resources are limited. The performance needs to adjust to match the conditions, and these adjustments are becoming more important to maintain an acceptable performance. To improve safety the focus needs to switch from seeing what goes wrong to what goes right. This is called Safety-II. The view of Safety-II foundation is to understand how acceptable outcomes (something goes right) happens in order to understand when adverse outcomes (something goes wrong) happen. In other words, Safety-II is a system’s ability to function under varying conditions so that the likelihood of acceptable outcomes are as high as possible. Safety management should make interventions and/or make preventions before something happens, in other words be proactive. This because it is an immense advantage to respond early in the process, which in turn leads to less of an effort to handle the consequences of an event, since unwanted events has less time to develop and spread. That is why the Safety-I approach is insufficient to deal with unpredicted disturbances, both in the long run and short run. However, a replacement of Safety-I with Safety-II is not the way to proceed in the future. Safety-I and Safety-II should be used as a combination in safety management thinking (Hollnagel, Robert & Braithwaite, 2015).

In relation to Safety-I and Safety-II, resilience engineering (RE) has a joint view. RE focuses both on what can go right as well as what can go wrong. In other words, RE is an approach to enhance the ability of an organization to continue to function in as many different situations as possible by looking for ways to enhance it (Hollnagel, 2011b). However, it is necessary to have a good understanding of what resilience is, how it can be measured, its determinants, how it can be maintained and improved to enhance resilience (Manyena, 2006). An organization is
safe if it is resilient and a safe organization it not necessarily resilient. Resilience, and therefore also safety, is not something an organization has but something it does (Hollnagel, 2011a). In other words, the performance of the system can be said to be resilient if it can change functioning before, during and after events such as changes, disturbances etc., and at the same time sustain required operations (Hollnagel, Robert & Braithwaite, 2015). The concept resilience inspires new ways in handling hazards and the consequences of hazards. It focuses more on how you can build something up rather than just reducing it. Also, it helps obtain a complete understanding about risks and vulnerability (Manyena, 2006).

What is important to bear in mind is that a system in itself cannot be resilient, but it can have a potential for resilient performance. As mentioned above, resilience has many different definitions, but a common thing they all share is the adaptability to keep the control when unexpected disruptions or events happens. However, all systems adapt, and it is not possible to say that resilience is just about adaptation (Woods, 2006). Resilience in a system is a wider ability, which means that there are applications of strategies, and that these strategies reduce the risk and consequences of faulty actions, unexpected events and complicated factors (Lundberg & Johansson, 2015). Woods (2006) says that resilience is also about how well a system manages disruptions. It is about to recover better in crisis and disruptions and how society becomes better equipped after a crisis the next time a similar event happens (Swedish Civil Contingencies Agency, 2013).

Socio-technical systems are becoming more complex and the need for resilience is increasing. There is a need to handle risks in safety critical systems, since the complexity makes it harder to see where the boundaries of the system are. Resilience is a way to handle this because of its proactive ways to manage new challenges in crisis situations. However, complexity in itself does not justify resilience as an approach, but increased complexity leads to new risks, which in turn requires resilience as a strategy to deal with it in non-transparent socio-technical systems. Resilience is seen as a capacity to adapt to complex and risky environments (Bergström, Van Winsen, & Henriqson, 2015).

The fundamental ability in a resilient system is its ability to adjust how it functions, according to Hollnagel (2011b). These adjustments occur either when something happens or before something has happened. This broad definition of resilient performance has been made into four abilities that are necessary for resilient performance. These are:
• Respond – the ability to know what to do or respond to regular and irregular changes, opportunities and disturbances. This can be achieved by actively preparing actions or adjust current functioning modes.

• Monitor – the ability to know what to look for or monitoring what could affect the system’s performance critically, both in the system’s own performance and in the environment.

• Learn – the ability to know what has happened or the ability to learn from past experiences.

• Anticipate – the ability to know what to expect or anticipate further developments in the future for example disruptions or changing operating conditions.

According to (Hollnagel, 2011b), there are four abilities because they can be recognized both in historical and in the present event analyses, and they are together sufficient without being redundant. The four abilities are necessary to have since they all, according to Hollnagel (2011b), make it possible for a system to have a resilient performance. Also, having these abilities in a system is an advantage in order to prepare for something that can potentially happen. Westrum (2006) discusses this in his paper about regular, irregular and unexampled threats. The author specifically discus three main aspects of resilience, which are recovery, foresight and coping. In addition to these three aspects he also discusses how to use these in a role-playing exercise (RPE) approach. This RPE method can be used for training to gain experiences to enhance skills and knowledge, so the participants can learn how to improvise, anticipate, and recover from states that are not desired (Woltjer, Trnka, Lundberg, & Johansson, 2006)

As mentioned in the beginning we should consider resilient performance not in terms of what it is, but what enables it. Resilient performance is also an organization’s ability to adjust functioning to expected and unexpected conditions. Therefore, resilience measures will be different from traditional measures of safety (Hollnagel, 2011a). Hollnagel (2011b) proposes a proxy measure called the Resilience Analysis Grid or RAG, and it is based on these four abilities that define resilience. RAG creates a “resilience profile” by having a set of four questions that relates to the four abilities, this to determine how well a system does on all the four basic abilities. These questions in RAG specifically address important aspects of each ability. It is important to bear in mind that these questions also need to be adapted depending on the particular target domain or application according to Hollnagel (2011b). Therefore, it is necessary to have some competence in RE and safety management, but most importantly
knowledge in the organization’s operation. The aim of RAG is not to provide a complete rating in how well a system does on the four abilities according to Hollnagel (2011b). The aim is to provide characterizations that are well-defined to create some sort of profile of a system that can be used to manage a system, but also to develop the system’s potential for resilient performance. RAG will help the system to see if there have been changes and then in turn manage the changes. According to Hollnagel (2011b) it is important to keep in mind that RE does not have a “standard” value and that there is no prescribed balance or proportion between the four abilities. However, RE states that to some extent systems should have these four abilities in order to have potential for resilient performance.

According to Manyena (2006), the concept resilience is still too vague to be useful in disaster risk reduction agenda. To achieve a consensus of the definition should therefore be a primary challenge for a researcher. Since there are a variety of interpretations of resilience (Bergström et al., 2015), it is hard to operationalize resilience into useful strategies and measurable indicators. Hollnagel (2011b) have made a try with his RAG. Johansson and Lundberg (2015) agree that there are conflicting definitions for what the term comprises and that there is no systemic framework for applying the terms. They have therefore proposed the Systemic Resilience Model (SyRes) model as a way to describe the process, functions and strategies associated with resilience. Johansson and Lundberg (2015) have tried to develop what is the core in resilient systems and applied that in their model. According to The Swedish Civil Contingencies Agency (2013), there is a need of a common concept of resilience that can be used in different areas of society protection and preparedness, and the SyRes model outlines six functions drawn from both disaster response and resilience engineering in effort to create such a common concept and can be seen in the upper part of the model (see Figure 1). These six functional dependencies are:

- **Anticipation** – expect what could possibly happen, which is essential for detecting and coping with events that are not wanted.
- **Monitoring** – detect the onset of events, and observation in the crucial system’s parameters and events, can potentially lead to detection of unwanted events that then can be avoided.
- **Response** – anticipation and monitoring detect an event but here is the actual execution of actions. Respond to events and take control over them.
• Recovery – damage from unwanted events are unavoidable, which leads to re-establishing damaged functions and operations. Recover from negative events, in short “bouncing back”.

• Learning – learning is a must and it also helps to improve the system responses to an event, improve barriers, and procedures for coping with an event. All this to withstand known disturbances.

• Self-monitoring – monitor and adjust all other functions ceaselessly, this to maintain the models’ core abilities, and the whole systems intrinsic ability to respond and adapt.

There are also five basic strategies concerning how the execution of resilience functions can be manifested, which can be seen in the lower part of Figure 1 (Lundberg & Johansson, 2015). These are:

• Immunization – make the system resistant to the menace. For example, if a slowly collapsing mine has a city above – move the city elsewhere.

• Avoidance – If there is no time or it is too expensive to eliminate a threat by making it immune, avoidance need to be conducted, such as an evacuation or a Tsunami warning system.

• Control – This strategy is implemented if it is impossible to immunize and avoid the situation, attempt to control for example a water flowing toward a city or control its effects instead needs to be conducted.

• Re-building – When all the above strategies have failed, systems can adapt a re-building strategy to re-taking what has been lost, such as repair damaged buildings.

• Knowledge – Another strategy when the other strategies have failed is knowledge, and by creating knowledge from learning increases the resilience of a system, for example by informing communities about threats and ways of coping with it.
Figure 1. The Systemic Resilience Model (Lundberg & Johansson, 2015, used with permission from the authors).

The model describes both resilient robustness, the contradiction between resilience definitions and the challenge to balance stability-enhancing properties (Safety I) with resilience-enhancing properties (Safety II). The model illustrates important features of a resilient system, such as being able to bounce back while maintaining core goals and at the same time being flexible with regard to instrumental goals. However, even if the model resolves the contradiction between being well-prepared and agile during a response a system can be resilient in all facets or in some areas in the model and vulnerable in another. That is why it is important to state in which part in the SyRes a system is resilient or has shown resilience (Lundberg & Johansson, 2015).

The term resilience has become more common in different contexts, specifically in both theoretical and practical terms in disaster response (Manyena, 2006). However, there are many
definitions of what resilience is and what it means. Resilience also has different meanings in different contexts, such as on system, society, and organizational levels (The Swedish Civil Contingencies Agency, 2013). To make clear what resilience means in this thesis, a definition from Boin, Comfort, & Demchak (2010) has been chosen: “Resilience is the capacity of a social system (e.g. an organization, city, or society) to proactively adapt to and recover from disturbances that are perceived within the system to fall outside the range of normal and expected disturbances” (p.9).

After a walkthrough of the development of systemic resilience another question appears - what is the future of resilience? According to The Swedish Civil Contingencies Agency (2013), the concept resilience will continue to spread and develop in more disciplines in the future. The concept resilience can hopefully become a tool that increases investments in preventions and efforts in society. In the long term and for sustainable development resilience is a prerequisite that can effectively protect and secure the investments in countries’ development (The Swedish Civil Contingencies Agency, 2013). As mentioned by Boin and McConnell (2007), there are two conditions needed in order to improve resilience: firstly, to get people to understand and create awareness that disasters can happen that paralyze state functions and infrastructures, without creating stress and anxiety; secondly, response mechanisms, such as warnings, evacuations etc., should exist and act autonomously as a response and this should not be replaced by resilience. Boin and McConnel (2007) also mention that there is no time to wait any longer to introduce and improve resilience. At the same time, is it difficult to convince organizations to invest in resilience since they are focused on their goals of becoming bigger, faster, better and more efficient.

Society must begin to realize that we cannot prepare for every possible scenario, because we cannot foresee the future. Therefore, improving resilience is needed as a preventive method against threats in the systems. Ljungkvist (2016) proposes to “design-in” resilience in society. He writes: “If we cannot predict what threats and disasters we are facing, will both the work in crisis prevention and crisis preparation become very difficult. Therefore, society can only try to adapt by “building resilience”.” (p.4, translated from Swedish)

2.3 Teams and team research

During the simulation games, the participants work in teams and together they have to try to cope with the disruption in the payment system. So, how can *team* be defined? There are many
definition of what a team entails, but one of the most common definition is Salas, Dickenson, Converse, and Tannenbaum (1992) definition: “A distinguishable set of two or more people who interact, dynamically, interdependently, and adaptively toward a common and valued goal/objective/mission, who have each been assigned a specific role of function to perform, and who have limited life-span of membership” (p.4). This definition is what Gorman (2014) calls team coordination and according to him, people that are coordinated into a team accomplish more than they would by working alone. People can, as a team, also perform tasks more effectively than by working individually. Even from complex cognitive tasks can a coordinated team perform tasks that an individual could not do alone. According to Salas, Cooke, and Rosen (2008), when organizations are faced with a complex and difficult task it has become common to use teams as a strategy of choice. In fact, they state that the dependency on teams in organizations are increasing. It is, however, important to differentiate between teams from groups, according to Garbis (2002). A group is a collection of members that not always has a common goal. On the contrary, a team has a common goal and distinct roles and responsibilities.

In a team coordination, shared knowledge is important, according to Gorman (2014). The importance of a team having shared knowledge is a shared cognition perspective in team cognition (Berggren, 2016). Shared knowledge means that a team has a common or complementary knowledge within the team members’ heads. In short, a shared mental model is about each individual’s mental model which overlap or complement another in both knowledge content and accuracy (Gorman, 2014). According to Salas et al. (2008), a critical driving factor of team performance is shared cognition.

There are two concepts that are essential in the shared cognition view: shared mental models and shared situation awareness (Berggren, 2016). Firstly, how the organised knowledge structure is shared in a team is what shared mental models are about. In other words, a shared mental model is all the participants’ shared mental representations and understanding about different aspects of their team and task. If a team has a shared mental model they are working toward a common goal with a shared vision of how they will achieve this goal. Secondly, shared situation awareness is about how each individual team member understands the situation, has a team situation awareness, and team process to support the team’s goals. Another concept, shared understanding, is outside of the team cognition research field. A definition of shared understanding can be found in Smart et al. (2009) as: “the ability of multiple agents to exploit
common bodies of casual knowledge for the purpose of accomplishing common (or shared) goals” (p.2). Shared understanding is both theoretically and conceptually closely linked to the term’s mental models and shared situation awareness (Berggren, 2016).

Moreover, team performance is, according to Gorman (2014), directly related to team members’ ability to coordinate activities and this, in turn, is facilitated from a shared mental model. At a team level, shared mental models, team situation awareness, and understanding communication are especially important component in how information is processed (Salas et al., 2008).

According to Gorman (2014), both team coordination and team effectiveness are enhanced by shared knowledge, because teams that have shared knowledge communicates better and coordinate without doubt, which frees up the mental resources of the team’s members. In addition, team effectiveness can increase if team members are compelled to interact in innovative ways during task acquisition as it allows the team to explore all the space of possible outcomes that could occur. Salas et al. (2008), explain team effectiveness as an evaluation of a team’s performance outcome, in relation to a set of criteria. Also, previous research has shown that shared mental models of a situation, task environment and interactions of team members are built during team training and increases a team’s ability to be effective under stress. If there is not good communication, coordination behaviour, and deficient cooperation, it can cause a side-track of the process of building a shared understanding of the situation between team members. Subsequently, this can in turn lead to inadequate performance and errors. Thus, team performance is enhanced by team training that promotes teamwork and several studies has shown that team training truly works. In fact, it improves both the coordination of team members and their understanding of each other’s roles. This trains teams skills assertiveness, maintaining shared situation awareness, and communication. To summarise, the quality of team processes and overall performance outcome increases through team training (Salas et al., 2008). However, there are factors that can influence team performance in a negative way, for instance team composition, work structure and task characteristics. To overcome these obstacles, teams can train explicit communication skills and strategies to coordinate, because it is vital to have a team with collective orientation as it likely increases attention to fellow team members and improves team performance outcome (Salas et al., 2008).

Furthermore, an example of a team training is simulation-based training (SBT), that has shown to be a powerful training methodology for team performance. This, because it let teams engage
in dynamic social, cognitive, and behavioural processes of teamwork. The team also receives feedback and gets a chance to correcting an error or fault based on their team performance (Salas et al., 2008). This is what the next section will be about: how simulation training, specifically a simulation game, can be used for team training.

2.4 Simulation games
The ability to simulate is an essential part of humans’ creativity and proactive evolution. During the 1980s simulations of cognitive process emerged as a field of research (Vincenzi, Wise, Mouloua, & Hancock, 2007). Two domains that have played a huge role in the history of simulation are war gaming and aviation. A paper by Kahneman, Slovic, and Tversky (1982) made a simulation heuristic that described how decision makers developed mental simulation. In the simulation heuristic there were five functions developed and these were: generating predictions, assessing event probabilities, generating conditional probabilities, assessing causality, and generating counterfactual assessments. Mental simulation was defined by Klein and Crandall (1995) as “the process of consciously enacting a sequence of events” (p. 324).

Furthermore, higher-level simulation was for many years the domain of technologists, but due to improved interface and increased accessibility to personal computers, simulation use has increased not only by technically oriented people. It is common with simulation tools during “first person” games, which led to that the distinction between simulation for work and play has become blurred. For example, both pilots and nonpilots can experience “flying” by using a flight simulator.

What is simulation? And since simulation has a close connection to modeling – is there a difference between simulation and modeling? The terms simulation and modeling have close links, and a joint definition is “the use of models, including emulators, prototypes, and simulators, either strategical or over times, to develop data as a basis for making managerial or technical decisions” (Vincenzi et al., 2007, p.6). Simulation is separately defined as “an executable implementation of a model, or execution of an implemented model, or a body of techniques for training, analysis and experimentation using models” (Vincenzi et al., 2007, p.6), while model is separately defined as “a physical, mathematical, logical, or other representation of a system, entity, phenomenon or process” (Vincenzi et al., 2007, p.6). Simulation and modeling have three primary domains, these are;

1. Training domain such as exercises, education and military operations
2. Analysis domain such as operation and evaluation
3. Acquisition domain such as research and development, testing and evaluation, and production and logistics (Vincenzi et al., 2007).

Why simulation is used has a simple answer; it is both effective and efficient. It is especially used in training of operators and maintainers, but it is also used to maintain and/or evaluate proficiency levels. Simulation and modeling are an important part in many human endeavors. However, there are advantages, disadvantages, and limitations that should be considered (Vincenzi et al., 2007). Firstly, simulation has many advantages: cost effectiveness, availability, safety, surrogate value, environmental problem reduction, improved training environment, standardized training environments and provision of data. Secondly, the disadvantages of simulation are failure to reflect real-world performance, equipment and facility costs, surrogate value and user acceptance.

As mentioned before, the increased number of personal computers has opened many opportunities for gaming and entertainment industries to develop simulations and simulators. This has also led to the fact that human behavior or human-like behavior is often simulated and has become more available to the general public. It started in the mid-1980s and has increased since then. For instance, simulation and learning have become more common and, in fact, many academics and universities use e-learning as a part of their education. Simulation gives an opportunity to go from the more traditionally linear-learning model to a more realistic non-linear-learning model. This, in turn, increases the experimentation and can be better applied in the real world. The increased presence of simulations in learning makes it possible to improve both the education and training processes (Vincenzi et al., 2007).

In summary, simulation is the interaction of human and system that provides effective means of training, evaluation, and analysis. It can also be used to study team process and team performance measures. During simulation, opportunities to establish, modify, and reinforce behavior that is required is possible (Vincenzi et al., 2007).

According to Johansson, Laere, & Berggren (2017), gaming-simulation is a specific form of simulation. Gaming-simulation incorporates roles to be played by participants and a game administrator. The participants and their (goal-directed) interactions are part of the simulation. Simulation-games can also be a physical simulation model such as a computer simulation,
board game etc. that is a physical reality the participant needs to interact with. When to use gaming-simulation is when “the how and why” of the interaction process between the participants are of interest and when these interactions cannot easily be incorporated in computer simulation models” (Johansson et al., 2017, p. 3). According to Johansson et al. (2017), the aim with gaming simulation is to represent reality, but also to have the actors experience the dynamics of a simulated system.

For several years, games have been used for other purposes than just entertainment. The perks with games are that it is a great learning tool and provide ways for participants to safely explore and fail. Also, it encourages personal and emotional experiences for the participants. Moreover, for a game to be successful, it is important that it present both fidelity and a good coverage of the interaction experience with consideration of the target learning goals (Prada, 2017). The term serious games were first coined in 1970 and the term came from the idea that games can be a tool for learning or in a more specific definition; “an explicit and carefully though-out educational purpose and are not intended to be played primarily for amusement” (Prada, 2017, p.31). Since the 70s, serious games have increased, and a new field of research has grown which developed the term.

There are two main reasons why applied games are suitable for learning. Firstly, they make it possible to practice and support proactive exploration and failure. Since games do not have a serious impact in real-life, players can explore and fail in the process until they achieve an outcome they are satisfied with or explore different outcomes. Secondly, games have a great impact on learning since they support the creation of personal emotional experiences. Games are often immersive and create strong emotional experiences for players. Things that have an emotional connection to a human, makes it easier for the brain to remember. However, even if games are a great learning tool, there are limitations in what the gameplay space affords (the options that are presented in the game) and it also depends on the target learning goals. For a learning game to be effective it all depends on the coverage (which make it possible for the player to explore options within the space that are relevant for the learning goals) and the fidelity (that the options in the game are credible so that the player can relate to them to the real-world action that the player is trying to learn) (Prada, 2017).

According to de Caluwé, Geurts, & Kleinlugtenbelt (2012), the strongest advantage with a simulation game as a research tool is that there is a possibility to manipulate variables
systematically in a realistic environment and measure the effect in a systemic way. In short, it gives the possibility to apply statistical methods in a qualitative study.

Taborda et al. (2015) introduced a new method for developing resilience skills by using scenario-based training. It can be challenging to both investigate and improving system performance or have sufficient detailed simulation for several actors’ core values. By having this scenario-based training that adapt the learning-by-experience-based approach, the challenging situation can be presented for the participants in a safe environment where they can test different actions and options to cope with unusual or even unexampled events (Taborda et al. 2015; Johansson et al. 2017). However, it can be challenging to capture and understand the interactions between the actors. It can be demanding and costly to make a simulation like this since it can require involvements of many actors and experts in order to evaluate what happened but also what it means (Johansson et al. 2017).

For this project, simulation gaming is used and the purpose by using this is to provide team-training in decision-making to see how the participants handle a crisis situation in a multi-organizational context. Why simulation games are used is because it is a unique opportunity to allow the participants to confront unusual and challenging situations without them having to endure the consequences of their actions or lack of preparedness (Laere, Berggren, Ibrahim, Larsson, & Kallin, 2018). During the simulation game, role playing will be used to create a powerful simulation environment. Players can collaborate with each other and implement their decisions in the simulation game and thereafter receive an output for the next playing round (Laere et al. 2018). The advantages and disadvantages with role playing and what role playing includes will be addressed next.

2.5 Role playing

According to the Cambridge Dictionary\(^1\) role play is: “pretending to be someone else, especially as part of learning a new skill”. More specifically, role-playing simulation is, according to Trnka (2009), involvements of humans, the setting is an interactive multi-person setting, and the reality or part of reality are reproduced. Role-playing simulation can be found as far back as in the 1960s and 1970s, and the methodology has been accepted in both the military and crisis management domain (Trnka, 2009).

\(^1\) Cambridge Dictionary: [https://dictionary.cambridge.org/dictionary/english/role-play](https://dictionary.cambridge.org/dictionary/english/role-play)
A study conducted by Woltjer et al. (2006) made role-playing exercises (RPE). RPE approach refers to: “methods where the participants in an exercise face a task conducted in real-time where the development of the task can be described as dynamic” (Woltjer et al. 2006, p.2). How participants act under uncertainty, time pressure, limited resources, and understand them is the main interest. RPE has its theoretical foundation in role-playing games. Role-playing games (RPG) are: “an interactive multi-person setting, where participants try to solve a problem or overcome various obstacles in a collaborative manner […], participants assume roles of various characters as well as their duties and tasks as specified in scenario” (Woltjer et al. 2006, p.72). These sorts of role-playing games have been used in the military as a training concept, such as war-games or tactical decision games, but also in emergency management. Role-playing games can be found in many researches in decision-making and behavior research, scenario planning, and evaluation of decision support system prototype. All these terms, role-playing simulation, role-playing exercises, and role-playing games are used kind of overlapping.

2.6 Observation protocol

This study uses an observation protocol called TRAMS. It is based on resilience theory, where strategies on how the teams in the simulation games manage disruption are observed. Observation protocol is a common method to use and is a sort of structure observation. The term structure observation, also called systematic observation, is a method where the researcher can use statements and fixed rules for observation and registration of behaviour (Bryman, 2001). These rules are a description of what the observer should look for and how they should note down what they observed. The rules can be called an observation scheme or an observation template. The purpose with an observation scheme is to ensure that every participants’ behaviour is registered in a systematic way, so all behaviours can be compiled in different behaviour categories that the researcher wants to study. The observation scheme should be specific and concreate, which make it easier for the observer to focus on aspects that are in interest (Bryman, 2001). This can be compared to the TRAMS protocol, where the strategies columns can be seen as a category of interest. According to Bryman (2001), one important advantage with this method is that it enables a direct observation of behaviour, which differentiate it from survey studies where conclusions about behaviour are based on the respondents’ statements. One possible disadvantage with observation scheme are that it sometimes requires a certain amount of interpretation from the observer. Therefore, guidelines
are needed for the observer to lean on (Bryman, 2001). In terms of TRAMS, guidelines have been created and are being developed more in this study.

Furthermore, compared to interviews and questionnaires, structured observations are, according to McCall (1984), a powerful tool and better suited for social interaction and organization. McCall (1984) brings up four points on how the method provides; “(a) more reliable information about events; (b) greater precision regarding their timing, duration and frequency; (c) greater accuracy in the time ordering of variable; and (d) more accurate and economical reconstructions of large-scale social episodes.” (McCall, 1984, p. 277). This is a strong support for structured observations. However, McCall (1984) writes that there are several problems concerning reliability and validity that the researcher is faced with when this method is used.

2.7 Theoretical synthesis

The previous sections have described fundamental theories and concepts needed to understand resilient behaviours in teams. How a crisis actually is handled depends on a crisis management teams’ ability to develop strategies that reflect core resilience functions, such as the ones described in the SyRes model. A teams’ effectiveness and performance are dependent on a team shared mental model of a situation and shared understanding. Team training has proven to increase these abilities and makes the team more effective during a crisis. It also promotes teamwork, coordination, communication and members’ understanding of each other’s roles. Simulation, observation, and role-playing are important concepts to understand since the study is based on simulation games with the observation protocol TRAMS. Both simulation and role-playing are important aspects for a team to learn and get a shared mental model. The TRAMS protocol is an observation and an evaluation of how well the team’s resilience process works. In addition, the simulation and role-playing can show how the overall performance outcome was and if the team training, in fact, increased the quality of the performance and team process.

The next part includes a description of the method used for measuring the factors mentioned in this part. Measurements are important in order to compare different teams with each other, and also to see how resilient the teams are in a crisis situation.
3 Methodology

This chapter is dedicated to explaining the methodology used in the study. It includes the collection of data, information about the participants, which material that has been used, and how the data has been analyzed.

3.1 TRAMS protocol

In short, the TRAMS protocol is an assessment method for resilience in simulation games, and it stands for “Team Resilient Assessment Method for Simulation”. The TRAMS protocol is in line with the SyRes model (Lundberg & Johansson, 2015), which is explained in the theory section. It is a challenge to assess resilience in teams and that is why the TRAMS protocol has been developed. TRAMS is an observation-based protocol used during game simulation that can be useful within research and training. The aim of this protocol is to support the identification of strategies used and developed by the participants in a game simulation. The overall purpose is to assess whether participants are able to develop strategies in order to manage various disturbances they may encounter in the simulation game and whether these strategies actually lead to positive outcomes. The TRAMS approach is based on the idea that actors from different organisations that would normally not be working together team up in order to manage a disturbance in the card payment system (Johansson, Laere, & Berggren, 2018).

Normally, simulation-based gaming is used to improve team resilience by creating scenarios that represent events that challenge the participants in such a way that they are pressured to engage in collaborative problem-solving activities. In addition, the participants are typically encouraged to apply familiar procedures or skill sets in training or exercise scenarios. In order to become more resilient, this is not the way to do it according to Johansson et al. (2018). Instead, events should be designed to challenge the participants’ resilience and each gaming session should be divided into at least three distinct phases. These phases are in line with the SyRes model, before, during, and after a disturbance. Before - can be evaluated in terms of the participants ability to anticipate the development of the crisis, likewise their ability to monitor important parameters and choose where to direct their attention. During - can be evaluated by the ability to avoid or cope with the disturbance. After - can be evaluated by the ability to learn from events as well as adapting existing strategies in order to better cope with similar events.
(Johansson et al., 2018). Therefore, the TRAMS protocol is based on these phases from the SyRes model.

The initial TRAMS protocol looked like Table 1 (Johansson et al., 2018). Since then, pilot testing has been conducted, where potential improvements were found. For example, the “core value” category was added at first, but later removed as it was hard to observe this at all during the simulation games. The column “Strategies in phases 1---N” has also been improved by creating five columns for each day in the simulation.

Table 1. The initial TRAMS protocol as depicted in Johansson et al. (2018)

<table>
<thead>
<tr>
<th>SyRes core functions</th>
<th>Strategies in phases 1---N</th>
<th>Related core value</th>
<th>Developed by…</th>
<th>Involved actors</th>
<th>Expected effects</th>
<th>Implementation</th>
<th>Simulator outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticipating</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitoring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controlling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recovery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To see what the latest protocol looks like, see Table 2. Further, the days 1-n was replaced by individual columns in the TRAMS protocol sheet, where each column corresponds to a decision event, i.e. days 1, 2, 4, 6, and 8.

Table 2. The latest version of the TRAMS protocol

<table>
<thead>
<tr>
<th>SyRes functions</th>
<th>Exercise run nr:</th>
<th>Date:</th>
<th>Team members</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strategies in day 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Strategies in day 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Strategies in day 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Strategies in day 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Developed by…</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Involved actors</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Expected effects</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simulator outcome</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Possible consequences?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In order to get a more detailed description on how the TRAMS protocol has developed, see Figure 2.

Figure 2. An outline of the TRAMS development timeline up until this publication.

**Column: SyRes Functions**

The first column to the left in the protocol represents the core resilience functions of the SyRes model found. These functions are there to guide the observer when identifying the different strategies used by participants during the simulation games. There are altogether six strategies listed in the protocol: *anticipating, monitoring, controlling, recovery, learning* and *self-monitoring*. The first strategy, *anticipation*, refers to actions such as brainstorming, consulting experts, discussing possible consequences of actions under consideration, etc. The second strategy, *monitoring*, is about earlier experiences or actions in the game, such as checking resources or cash flow in the simulation to better understand the disturbance. The third strategy, *controlling*, is the action that are implemented in the simulation game to cope with the disturbance. The fourth strategy, *recovery*, is about what is anticipated, currently happening and what happens after a disturbance. An example of this is whether all the ATMs contain enough money to support an unexpected disturbance in the card payment as it then can become less severe. The fifth strategy, *learning*, is based on what you learn from the disturbance such as creating a report system or assuring that experiences identified during an event are incorporated in staff training etc. Lastly, strategy *self-monitoring* is about self-criticism or
reflection needed to modify the way the team works. For example, changing decision mandates or a re-organization of responsibilities within a team.

Column: Strategies in Days 1---N
These columns represent the fictive days and reflect the events in the simulation game. Normally, these are known to the researcher and can be described in the protocol. All the identified strategies should be noted down on the corresponding day to make it possible to track which strategy was developed on which day. There can be several strategies developed on certain days, while other days may include no strategies at all. This completely depends on the participants and the outline of the scenario used in a particular gaming simulation.

Column: Developed by
From whom a specific strategy originates should be noted in this column, in order to see whether it was a collective decision within the team, or whether an individual participant suggested it. This information can then be used to assess how well collaboration between the different participants work, who of the participants takes initiative, and whether certain organisations are more prone to pushing strategies.

Column: Core Values
This column was included in the initial TRAMS protocol, but since it was hard to utilize this in the simulation game, the column has been removed in the new version. Initially, this column was for the core values that was affected by, or connected to, the strategy observed, for example revenue of a supermarket. Core values are central to the SyRes model and it explain what strategies developed actually aims to protect but cannot put to use in the TRAMS protocol.

Column: Involved Actors
Normally, several actors will be involved in the implementation of a strategy, both within the participating team and “external” (simulated) actors in the gaming simulation. These should be noted in this column if it is possible.
Column: Expected Effects

If it can be captured, it should be noted in this column what kind of effects the participants express that they think the specific strategy they implemented will have on the outcome of the gaming simulation. This can be used to analyze the participants understanding (mental model) of the scenario and their actions.

Column: Implementation

This column should note if a strategy was implemented and in what way. In this study, Combitech noted the strategies the participants wanted to implement, which made it very clear if the strategies were implemented or not. This also makes it possible to fill in the column subsequently.

Column: Simulator Outcome

In this column, the outcome of the simulator from the strategies should be noted. This can be used for the analysis and the de-briefing session afterwards. Three major performance areas are important according to Johansson et al. (2018): 1) payment options, 2) goods flows, and 3) security.

3.2 Data Collection

The data has been collected through simulation-game sessions in cities all around Sweden. At the different locations, the project group collected the data during one day, where different participants (the participants differ slightly between sessions) from various different industries, such as petrol, food, municipally, banking, police, government, security etc. gathered to participate in the simulation games. There were two simulation games played during the day, one long session before lunch and one shorter after lunch, as they by then knew how it worked after having played it once before. The people in the project group had different tasks during the data collection. Consultants from Combitech AB was noting all the implementations the participants wanted to do in the game. A representative from Skövde University was the one that interacted with the group, distributed information and led them through the session. Representatives from Mid-University were responsible for the simulation game, which means that they implemented the solutions that the participants came up with and ran the game. Representatives from Linköping University were responsible for two things: observation with
the TRAMS protocol’s different resilience strategies and collection of data through surveys on workload, TMX and shared priorities.

3.3 Participants

In the data collection, seven teams of participants participated in the 14 simulation games, where each team played two games. Each team was composed of 7-9 participants from representative businesses, authorities and public organizations. These teams were *ad-hoc* teams, which means that they were a temporarily organized team where members were included because of their organizational background and experiences. The team members might not have met prior to being part of the team either.

The *first team* consisted of 7 members: one representative from a fuel store, two representatives from a food stores, one from media, one banker, one from the county administrative board, and one from a cash transportation company.

The *second team* consisted of 7 members: two food store managers, one representative from a food store, one police, one banker, one from a cash transportation company, and one from the municipally.

The *third team* consisted of 8 members: one police, one representative from a food store, one representative from a fuel store, one from a cash transportation company, one banker, one from the municipally, and two from the county administrative board.

The *fourth team* consisted of 8 members: one representative from a fuel store, two representatives from food stores, one banker, one from the public transport, one from the municipally, one from the county administrative board, and one from a cash transportation company.

The *fifth team* consisted of 9 members: two representatives from food stores, two from the county administrative board, two from the municipally, two from regional public health care system, and one from a cash transportation company.
The *sixth team* consisted of 7 members: three from the national Swedish board of health and welfare, one from the municipally, one banker, one from a cash transportation company, and one food store manager.

The *seventh team* consisted of 9 members: two representatives from food stores, two from the bank, one from a cash transportation company, one police, one representative of ATMs, one representative from a fuel store, and one from the municipally.

### 3.4 Procedure

At first, a consent form and a background form about the participants’ professional experience as well as their experience with crisis response events was filled in. The project leader then explained the background of the CRRAAAFFTTING project and the scenario outline for the simulation. The shared priorities form was also introduced for the participants, to let them know how to answer it. The simulation and the audio recordings started after this. Two researchers were available at all time during the simulation game to answer any questions the participants had about the simulation or other concerns. The participants in the simulation game takes on the role as a crisis response council. Their task is to suggest actions to handle the situation of card payment disruption on days 1, 2, 4, 6 and 8 in the simulation game. To handle the situation, they are free to implement different actions to prevent the situation to escalate, for example introducing new means for payment, providing information to the public, changing the number of security guards or police officers in stores and society, changing the opening hours of stores or petrol stations, or even closing them, etc.

Other data was also collected during the simulation games to be used for other studies. During breaks and after every simulation game run, the participants filled in team work load (Funke, Knott, Salas, Pavlas, & Strang, 2012; Helton, Funke, & Knott, 2014), and shared understanding (Berggren, Johansson, & Baroutsi, 2017; MacMillan, Paley, Entin, & Entin, 2005). After the simulation game, it was time for team-member exchange quality (cf. Seers, Petty, & Cashman, 1995; Willems, 2016) to be filled in and an evaluation of the day was conducted. To explore more in-depth what the process looked like during the simulation games, see Figure 3.
The TRAMS instrument is all the measurements (observation protocol, TMX, workload, shared priorities, and perceived complexity) that are used during the simulation games.

The focus in this thesis is the observation protocol, TRAMS. During every simulation game there were three observers equipped with the TRAMS protocol. They all sat adjacent to the participants, so they all could see the participants and the simulation game output (see Figure 4 for an example of placement in the room). The observers had no strict guidelines on how to use the protocol, other than the guidelines from Jaber, Johansson, Bergsten, Berggren, & Laere (2019). The observers tried to utilize as many of the components of the TRAMS protocol as possible during the simulation. The observers compared their notes with each other in terms of the protocol after the games to analyze similarities and find differences between each other, and to discuss how they thought about different strategies and how to categorize the team’s discussion. The aim was to see if the protocol could be used as a tool in the future.
3.5 Scenario

The scenario of the simulation games is a disruption in the payment system, specifically, a scenario where the card payments function shut down for ten days, while cash withdrawals, internet- and tele- bank and online payments are still working as normal. The simulation is based on a model of southern Sweden (Lund, Malmö, Lomma and Staffanstorp), which include both large cities and rural areas. The simulation is modeled in terms of stores (ranging from small to mega-stores) and petrol stations (both manned and unmanned), transactions, petrol, flow of goods and payments, customers and the amount of cash available in ATMs etc.

3.6 Material

Below are the materials used during the simulation games identified and further explained.

3.6.1 Instrumentation

During the simulation games, audio was recorded with Zoom R8 with an Aston Spirit microphone to support note-taking with the TRAMS protocol.

The simulation platform AnyLogic™ was used to run the simulation game. The model is an agent-based simulation model of the payment system which simulate the business and consumer consequences when a disruption happens in the payment system for food stores, fuel stations and the bank sector in order to extract resilience. A Geographic Information System
(GIS) model is used to visualize the locations of food stores, gas stations and ATMs in southern Sweden. The total population is 440,000 citizens in the simulation and the model creates an architecture of three main components, which is retail market offer, the consumers’ behavior and the payment system. The model is based on the typical shopping behavior from available statistics from SCB Statistics Sweden and the estimates made by the modelling team (Laere et al., 2018). The simulation is from day 0 to day 10 and each simulation runs starts at 06.00 and continue for 9 days.

During the simulation game, other data was also collected, such as consent forms, TMX, workload and shared priorities. These measurements are used in other studies.

3.7 Data Analysis
To interpret the data, two methods have been used: transcription and thematic analysis, in order to collect insights about what has been observed during the simulation games, but also to examine how to identify strategies in the TRAMS protocol. The TRAMS protocols that has been analyzed are the ones where at least two or more observers did observations during the simulation games. Out of the 14 simulation games, eight games had three observers and six games had two observers.

3.7.1 Transcription
The recorded audio from the data collections was used as a reference when interpreting the notes taken with the TRAMS protocol. From the recordings, selected parts were transcribed in order to gather excerpts that illustrating the various strategies that were identified during the simulation games. They were therefore not randomly chosen. The excerpts that were judged to be representative of the strategies identified during the simulation games were selected and transcribed. The observers also compared the number of observations relating to each strategy, as well as an initial assessment regarding what actually was noted (what the strategies relates to). What was not observed and what components of the protocol that were not used was also discussed between the observers. In addition, all the observers had a mini workshop were the data was discussed and how the data should be analyzed.
3.7.2 Thematic analysis

For the analysis of what has been observed, a method called thematic analysis has been used. According to Howitt (2010), thematic analysis is a qualitative data analysis method and is less dependent on theory. It is an analysis for finding major themes in qualitative data. The themes should describe in depth what is going on in the data. However, this is harder than it sounds. Therefore, the analyst should have an intimate knowledge with the data by for example collecting, transcribing, reading, and re-reading the data oneself. After this, the coding of the data begins. It is from these codes the analyst develops and identify the themes which describes the major features of the data (Howitt, 2010). In short, thematic analysis is that data get structured and categorized to different themes and based on these themes are the results summarized. According to Howitt (2010), thematic analysis is a more descriptive method because themes intend to describe what is happening in the data, in other words: “thematic analysis is the analysis of what is said rather than how it is said” (Howitt, 2010, p.164).

What counts as a theme? According to Braun and Clarke (2006), a theme is something that capture the most important things in the data in relation to the research questions. These themes represent some kind of answer or meaning that can be seen as a pattern in the data. The most ideal situation is that there are a number of cases of the themes throughout the data material.

Themes can be identified in two ways: inductive analysis or theoretical analysis (Braun & Clarke, 2006). In this thesis has an inductive, or “bottom up”, thematic analysis been used. This means that the researcher codes the data without trying to make it fit into the already existing coding frame or the researcher’s analytical predictions. In short, the researcher find theme by starting from the empirical material which is then categorized and analyzed.

Braun and Clarke (2006) has a step-by-step guide in how to do thematic analysis. The authors have broken it down to six phases: (1) familiarizing yourself with your data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the report. For a more detailed description of the phases, see Braun and Clarke (2006). The analysis process is not a linear process but more a recursive one, which means that the researcher constantly moves back and forth between the different analysis steps (Braun & Clarke, 2006).
4 Ethics

In this project, ethics have been considered. Consents form are signed before the data collection begins and all participants know they are being recorded. They also know they can leave whenever they want and are participating in the project voluntarily. If they want to quit the experiment, the data collection from them will be erased or if they regret saying something, that data will not be used. They also receive the information that all data will be used for science and nothing else. The participants’ personal details are also kept anonymously by creating a designation system. All this is in line with Vetenskapsrådets (2002) four principles of research ethics.
5 Results

This chapter is divided into four parts. Firstly, what strategies that were observed during the simulation games. Secondly, how the observers have noted the observed strategies. Thirdly, the themes that were found during the simulation games are described. Lastly, a guide on how to use the TRAMS protocol for future data collection has been created.

5.1 What strategies were observed during the simulation games?

In the study, three observers, A, B and C, noted the strategies used by the participants. The total observations per category of strategies from all the 14 simulation games can be found in Table 4. From the data collection, four of the six core resilience functions were found: anticipation, monitoring, controlling, and self-monitoring. The strategies recovery and learning were not observed during the simulation games. However, the strategies monitoring, and self-monitoring were used very little during the games but have been found in some games. The criterion for a strategy to be included in the analysis was that a minimum of two observers needed to have observed the same strategy. Therefore, strategy learning is excluded from the analysis since only observer B identified it, and the same for recovery, since no observer identified it. A table presenting the frequency of the different strategies can be seen below in Table 3.

Table 3. Total observation per category of strategy by each observer and the average in total in percent.

<table>
<thead>
<tr>
<th></th>
<th>Observer A</th>
<th>Observer B</th>
<th>Observer C</th>
<th>Total average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticipation</td>
<td>74%</td>
<td>71%</td>
<td>77%</td>
<td>74%</td>
</tr>
<tr>
<td>Monitoring</td>
<td>1%</td>
<td>2%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Controlling</td>
<td>25%</td>
<td>23%</td>
<td>24%</td>
<td>24%</td>
</tr>
<tr>
<td>Recovery</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Learning</td>
<td>0%</td>
<td>0,3%</td>
<td>0%</td>
<td>0,1%</td>
</tr>
<tr>
<td>Self-monitoring</td>
<td>0%</td>
<td>3%</td>
<td>1%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Interesting to note is how much agreement there seems to be between the observers when filling in the TRAMS protocol. Observer A did in average 76.7 observations, observer B did 77 observations, and observer C did 77.8 observations during a simulation game.
5.2 How similar are the observations in the TRAMS protocol between observers?

Calculations showed that the observers average of observations were 76.7, 77, and 77.8, which is very similar. The distribution of which strategies that could be found during the simulation games of the observers are also very similar (see Table 4). Therefore, an interesting aspect with the TRAMS protocol is to compare how similar the observations have been between the observers – are the strategies they have observed similar?

When comparing the three observers’ observations many are very similar and there is much repetition as well, but there are some small differences. Concerning the observations of *anticipation*, there are many similarities. One similar example noted is when they discussed problems with change: Observer A: “Change are needed, can handle cash, but not change”, observer B: “There is too little change”, observer C: “The problem is the change”. Another similar example: Observer A: “Swish and cash payments still works and is inserted”, observer B: “go over to Swish, the first thing we do”, observer C: “We could go over to Swish”. Some difference noted that still have the same basic meaning is: observer A: “30 minutes it will be reported directly in the media”, observer B: “social media will spread information”, Observer C: “Social media will cause ATMs to be emptied faster”.

In the strategy *controlling*, the notes are even more similar since it was clearer what exactly the teams implemented in the simulation. One example, of when they wanted to close the unmanned fuel stations in the simulation is: Observer A: “unmanned fuel stations close down”, Observer B: “unmanned fuel stations close down, cannot pay”, and Observer C: “fuel station closes down directly when payment stops”. Another example of the strategy *controlling* is when they want to communicate with the society and implement this in the simulation game: Observer A: “communicate and give out information”, Observer B: “communicate that you can only pay with Swish”, and Observer C: “inform that payments do not work”. They have all the same interpretation that the team want to communicate and inform in the game, but the notes differ a little.

5.3 What themes can be found from the simulation games?

By analysing the TRAMS protocol with a thematic analysis eight themes could be found:

- Coordinate and collaborate
- Payment options
- Cash circulation
- Fuel and transportation
- Safety
- Inform, communicate and the media
- Hoarding and rationing
- Vulnerable groups

The majority of the findings turned out to be from the strategy _anticipation_. To see the frequency of the theme in each strategy see Table 4.

Table 4. Number of observations of the theme in the data, the occurrence of the theme in the data in percentage, and where each theme was found in which strategies.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Number of observations</th>
<th>Observation in the total data</th>
<th>In which strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coordinate and collaborate</td>
<td>110</td>
<td>7%</td>
<td>61% Anticipation 39% Controlling</td>
</tr>
<tr>
<td>Payment options</td>
<td>328</td>
<td>21%</td>
<td>67% Anticipation 32% Controlling 1% Self-monitoring</td>
</tr>
<tr>
<td>Cash circulation</td>
<td>283</td>
<td>18%</td>
<td>74% Anticipation 2% Monitoring 24% Controlling</td>
</tr>
<tr>
<td>Fuel and transportation</td>
<td>239</td>
<td>16%</td>
<td>74% Anticipation 1% Monitoring 25% Controlling</td>
</tr>
<tr>
<td>Safety</td>
<td>122</td>
<td>8%</td>
<td>70% Anticipation 2% Monitoring 28% Controlling</td>
</tr>
<tr>
<td>Inform, communicate and the media</td>
<td>218</td>
<td>14%</td>
<td>63% Anticipation 1% Monitoring 36% Controlling</td>
</tr>
<tr>
<td>Hoarding and rationing</td>
<td>136</td>
<td>9%</td>
<td>92% Anticipation 1% Monitoring 4% Controlling</td>
</tr>
</tbody>
</table>
An important thing to note before continuing reading the themes is that all the themes presented down below are based on the participants’ reasoning and speculations. So, it is the participants’ reasoning that forms the basis of all claims made. Furthermore, it is not certain that the participants’ speculations and reasoning are correct.

5.3.1 Theme: Coordinate and collaborate

In a crisis situation coordination and collaboration are important according to the participants. This theme can be found several times in the simulation games. The participants often discussed that they need to coordinate, both their communication to society to create a feeling of security, and how they can collaborate between different organisations to create order and structure. The participants emphasised how important it is to collaborate with important actors involved, such as media or municipality, and that the coordination and collaboration needs to start early in the occurrence of a disruption or crisis situation.

The participants think it is an important aspect to start a dialog between the actors involved and try to keep functions open. They need to coordinate together and communicate between functions. The county administrative board, for example, needs to communicate with the banks, the municipalities needs to spread help and coordinate both elderly care, schools and transports. The participants also discussed that a crisis board needs to form, and that an emergency management group or a collaboration conference with important actors should be put together by the municipality and the county administrative board. Together they will try and coordinate what should be said to the public, what the different actors will do, what resources there are, which resources need to be prioritized and in general try to create a situation awareness. There will also be internal crisis groups in different actors’ organizations, such as in the banks and food stores. The point with these crisis management groups are to support each other and help with giving information, but also determine what actions needs to be taken. As noted before, coordination and collaboration are very important, and it is essential to show a united front so that smearing campaign does not happen according to the participants.
5.3.2 Theme: Payment options

In all the simulation games, payment options are naturally discussed, since the card payment has broken down. Participants discussed several different ways in which payments can be done, such as cash, Swish\(^2\), invoice, club card, manual routines, apps, online- and offline-payments, or by bringing other types of terminals to the stores (Izettle) etc. The participants thought that it is important to show that there are alternative payment options. However, in practise it is harder to implement these options.

The first option that almost all teams brought up is Swish as an alternative. However, there is much discussion if Swish can handle the pressure if everyone uses Swish, since there is a chance that Swish will crash. In addition, not everyone has a phone, bank-ID or ID. There are also differences in the population; elderly people probably have more cash and uses Swish less or not at all, and the younger population probably have less cash and uses Swish more. Not all stores have Swish as an alternative either, and if they have to open up an account for Swish the banks will get a lot of pressure. When Swish crashes, which is inevitable according to speculation, there is still cash, online payments and offline payments; but these payment options will most likely create larger queues and a lot of pressure and stress on the personnel and security.

Many stores will also have problems with using other payment options than cash, according to many food stores participants. Another difficulty is the credit risk with invoice which is a complicated issue. Many stores do not want to take the risk and not all people can be invoice costumers either, since it is hard to do a credit control. An option could be online payments. People can, for example, buy food via stores’ web pages and collect it in the stores, but not all stores have this option and not all people know how to use it, such as elderly people.

There are also differences in payment options between countryside and city. In the countryside, stores may know their costumers and can write down payments that can be paid after the disturbance, but in the city and in bigger stores this is harder, if not impossible, to do.

\(^2\) Swish is a mobile application for money transfer
These new payment options, as mentioned above, causes constraints and stress in the personnel. The participants thought that new opening hours probably must be established, and that extra personnel are needed, especially if manual routines are implemented.

A desirable thought is that there are a lot of payment options, but at present this is not the case according to the participants. There is a problem in today’s society that there are not many payment solutions, and the solutions that exist have dilemmas. The biggest solution, Swish, will crash and after that the best alternative is cash. However, there is many difficulties with this also, which will be discussed.

5.3.3 Theme: Cash circulation

When card payments stop working and Swish crashes, cash payments are considered by the participants to be the next best choice. However, today’s society do not have the capacity anymore to handle big amount of cash, and there is not a large supply of cash present either. The ATMs will be emptied quick and the money transportation is a slow process. Some ATMs do not even get filled up within a week. In addition, there is no longer as many money depots as they were before, according to the money transportation companies.

Circulation of money is needed, and exchange of money is important. There will be pressure on the banks and the participants think that the banks need to open up and be able to handle cash again. The banks opening hours need to be longer and this in turn require more personnel. There also needs to be priorities, for example which ATMs should be filled up, how much should be filled up, which operation should the money pick-up prioritize, and which bank offices need to open for the public. However, the problem lies in the circulation of money – the money does not get out to the ATMs and banks as they stack up in the stores, because the transportation of money cannot keep up. According to the transportation companies, the capacity to deliver this huge amount of money does not exist. In addition, stores that do not have a contract with the transportation company cannot use their services and a new contract takes about seven days to fix. Transportation needs fuel as well, and this can be hard to get if you cannot pay, but this will be discussed further down. An important aspect is to get cash flow, otherwise society stagnates in many different ways. Food and fuel cannot be bought, and frustration will rise, the participants speculate.
A solution suggested by the participants is to introduce a max withdrawal. This to prevent the ATMs getting empty and people from hoarding money. However, there are probably differences in the population in how many uses cards and how many cash. Maybe elderly have more cash at home than younger. The cash buffers between people will probably vary. Another solution suggested by the participants is to accept other currencies such as euro etc., or fly in money since the money is not printed in Sweden anymore and the national bank have money in different countries. However, this new supply of money still needs to get circulated, which is, as mentioned before, hard to do. In addition, the Swedish krona can lose its value. A solution, suggested by the participants is to develop new payment methods, since we cannot handle them. In addition, there must be a fundamental security in society – it is not just possible to add a lot of cash, the participants think.

Even here differences between countryside and city exist. In the countryside, they can create their own money flow between each other, which is not possible in the city. Therefore, participants speculate that the problem may not be as big in the countryside.

Another problem the participants thinks is important is the security – how can the transportation company transport the money in a safe way to resupply the ATMs? The participants speculate that they will probably be robbed if they do not have guards, such as police or military escorts. It can also become dangerous for banks to keep open. Rumours that stores have a lot of cash stored will also be spread. All this leads to another important aspect in a crisis situation – safety.

5.3.4 Theme: Safety
The need of guards will increase in this situation since people might become frustrated, scared and angry, according to the participants. One problem with this, the participants speculated, is that the guards we have now will probably not be sufficient, which leads to the police and military needing to help out. In addition, there is a dilemma: can more guards create more security, or will it create worries? Or is it a necessity to have, for example, police out in the streets to calm people down? Whichever, guards will be needed in stores, banks and petrol stations, since they are very vulnerable. Security must be maintained in some way, according to the participants, and guards, police and military are a solution they came up with for this. Also, guards, police and military will be needed for the transportation of money, as mentioned before. The participants think that there need to be priorities here too, since there are limited resources in guards, police and military, for example: which stores, ATMs or petrol stations
needs the most protection? Maybe some stores need to close since the security capacity is not
enough. Big stores are probably in bigger need of security than small stores, too. There will
also be queues at the petrol station that needs to be kept under control.

5.3.5 Theme: Fuel and transportation

All these themes are in a way connected to each other and fuel and transportation is not an
exception. As mentioned before, fuel is needed for the transportsations of goods and cash and it
will be difficult to access this if the payments are disrupted. Fuel is an important part of the
society, and lack of it will lead to disorder.

According to the participants’ speculations, priorities are also needed here. Should everyone be
able to refuel and should important society services, such as ambulances or fire trucks, have
priority over everything else? It can be that cars and trucks will get stuck in the streets and
deliveries of food, too. Transportation of food to the stores must also be prioritized. If food
delivery is not prioritized, it will in turn naturally lead to a food shortage in the stores, and stores
will have to close. That is why it is important to prioritise critical societal actors and get the
fuel flowing, but also security so that the deliveries do not get robbed, according to the
participants.

Here it is important to inform people not to use their cars unnecessarily. Participants suggest
that if people can they should stay home and work from home. Carpool is also a suggested
option from the participants. However, there can be a problem already when people go home.
Cars will get drained from fuel and people will probably hoard and steal fuel too, the
participants speculate. People will get encourage to use other transportation alternatives, such
as bikes etc.

The participants speculate that the petrol stations are vulnerable, especially unmanned ones.
They think that there will be long queues will be created at all the petrol stations. There will
also be more traffic to the manned stations since they have more payment options. One
possibility suggested is to control the tankers and only fill the manned stations with fuel. In
addition, a possibility could be to steer the traffic from unmanned petrol stations to manned
ones and have longer opening hours. Or, as an alternative, the unmanned stations could be
manned. This may be necessary in the countryside where there are almost only unmanned
stations. However, this may work for larger chains, but not for smaller since they do not have the amount of personnel required, the participants suggest.

One solution suggested by the participants is to mainly use public transportation, such as buses or trains. In addition, let people who cannot pay for the transportation go for free. The public transport can also be a way to transport people to important areas, for example areas where there are fuel and goods. However, increased pressure in the public transport can also be difficult to handle.

5.3.6 Theme: Inform, communicate and the media

All teams state that information is very important. Traditional media and social media will also play a big part in how society will react, the participants speculate. For example, costumers need to be informed in the stores, banks need to get out information to their customers, and information in recommended measures will get out. According to the participants, it is also important to provide information regularly, both to calm the people, inform them what to do, and to try stop the hoarding. There is also a need of targeted information, for example information in several languages.

Many teams think that media will probably denigrate the authorities which will create worries and scare. Media will probably blow the crisis up enormously and paint a picture of chaos. That is why the participants suggest that authorities need to inform and show people that there are payment alternatives and solutions. It is also important to give coordinated information and not a provoking message which risk frightening citizens. However, information and communication will not solve the problem in the long run – people will stop trusting it after a while if it is not correct, the participants think.

According to the participants, communication is important between authorities and media, so that the media can be used as a megaphone. However, information from authorities and media can create the opposite effect, which will lead people to start hoarding because they are scared. This will be addressed next.
5.3.7 Theme: Hoarding and rationing

Hoarding seems to be unavoidable in a crisis situation, according to the participants. They think that people will hoard money, fuel and food. The participants think that information can maybe slow the hoarding down, but not get rid of it completely. So, how can hoarding be solved? Will it slow down when people have filled their pantries? Or is an alternative rationing needed?

Participants suggest that stores need to priorities which goods that needs to get delivered to the stores. Luxury goods and unnecessary food such as soda, chips, candy etc. should not be prioritized, they think. The pressure will be higher on some goods as well. There is no stock to take care of the increased hoarding and there will be a lack of goods because of the transports, they speculate. In addition, automatic ordering of food will also lead to the stores buying goods nobody wants in a situation like this. An alternative suggested by the participants is to change the prices of products. In addition, spread the goods on the shelves so they do not look as empty, which in turn can stop the hoarding a little. Also, participants suggest changing the supply in the store and focus more on basic goods. It seems likely that there will be a shortage of goods, the participants think.

A suggested solution by the participants to the hoarding problem can be rationing. Which mean setting a limitation in how many products each family can buy and have central locations that provide the goods. According to the participants, the state must go in with some subsidization for both fuel and food, so that people do not pile up food and have fuel stored at home. In addition, make sure that food will get to critical places, such as schools and retirement homes. The participants speculate that this in turn will probably lead to a black market. However, there will be vulnerable groups that are not able to hoard, get food, and money. This will be discussed next.

5.3.8 Theme: Vulnerable groups

During a situation like payment disruption, some people or groups in society will get more affected than others. According to the participants, the national board of health and welfare must get involved to help vulnerable people who will not have food and any way to pay because of various reasons. Some have no phone, bank-ID, ID, possibility to pay with credit etc. The most vulnerable groups, according to the teams, are those who have less money and cannot take out the max amount of money, and there is a need to map out the most vulnerable groups. The
participants think that responsible actors need to rig up a place were vulnerable groups can go to get help. The national defense can maybe get the responsibility to bring out food to people. A solution, suggested by the participants, can also be for the state to go in and guarantee payments for people who cannot pay at the moment. Voluntary organization, such as the red cross and churches, needs to get activated and soup kitchen needs to open up, since maybe more people are vulnerable in a situation like this and the resources are not enough. It is important to maintain some sort of basic structure with medicine, food, alcohol etc. The participants think that the survival instinct will shine through when people do not have cash and an empty refrigerator. On solution for this can be that the municipally give requisition and help with credit payments. A speculation made by the participants are that if people do not get help there will be a survival behavior and people will try to solve the shortage of supplies on their own, which is not desired.

Pharmacy and medicine are a very important part that needs to work and has to be prioritized. Pharmacy is a vulnerable point in society that the state must go in and support. According to the participants there are also needs in this area that has to be prioritized – which of the vulnerable groups are the most vulnerable?

Another problem the participants finds in society is the groups that need alcohol, tobacco and other addictive substances. It is an important factor that needs to be considered. If people who are addicted do not get their substance it can create an unwanted behavior which needs to be prevented, by, for example, having more guards and police out in the streets according to the participants.

The participants also speculate whether there are differences between the countryside and the city. The police and guards will not priorities the countryside and the emergency service response times is very long if you live in the countryside. Criminals will therefore prioritize the countryside, the participants think. In addition, small towns have no redundancy for supplies such as food or fuel. Many of the fuel stations are unmanned and the payment options fewer. On day six of the crisis and onward will it for many be about survival, according to the participants. However, the participants think that the countryside will probably make it farthest when something like this happens, because they can write in the store what people have bought because they know each other, and they can help each other.
5.4 Guidelines and examples

To be able to use the TRAMS protocol for future data collection some guidelines have been created. They were created to make the protocol easier to use, but also to make its use consistent between observers. These will now be presented.

When using the protocol, observers should only note one strategy for each row in the protocol to avoid mismatches in the number of strategies observed. In addition, every strategy should count as a separate observation. For example: if participants are discussing the sales figures and the amount of cash in the ATMs, this should count as two separate observations and not one. Each observation should be noted in two separate rows. For an example of how to fill in the TRAMS protocol see Table 5.

Table 5. Example of how the TRAMS protocol can be populated during a simulation game.

<table>
<thead>
<tr>
<th>SyRes functions</th>
<th>Exercise run nr:</th>
<th>Date:</th>
<th>Team members</th>
<th>Strategies in day 1</th>
<th>Strategies in day 2</th>
<th>Strategies in day 4</th>
<th>Strategies in day 6</th>
<th>Developed by…</th>
<th>Involved actors</th>
<th>Expected effects</th>
<th>Implementation</th>
<th>Simulator outcome</th>
<th>Possible consequences?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticipating</td>
<td>Pharmacy can become a problem</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitoring</td>
<td>Who gets the responsibility to make sure that vital functions get fuel?</td>
<td></td>
<td></td>
<td>Regional public health care system</td>
<td></td>
<td></td>
<td></td>
<td>Municipally</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controlling</td>
<td>Clarification of a graph of failed refueling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The county administrative board</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controlling</td>
<td>Go out with information that we will solve this</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The county administrative board</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recovery</td>
<td>More money in ATMs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>All</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Self-monitoring</td>
<td>When did we put in the max amount of withdrawal of 200kr (referring to the game before)? Maybe that was too early to do?</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cash transportation company</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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Each type of strategy in the protocol is designed to capture the team’s resilience behaviour. The first strategy, *anticipation*, is when participants discuss and brainstorm possible actions but never implement them in the simulation game, at least not during the game-turn the discussion takes place. Participants can, for example, discuss that people may start hoarding money, “*Hoarding of money can arise*”, but neither check if they actually are hoarding (monitor) nor prepare to mitigate the problem (controlling). Another example is when the participants discuss how fuel will impact important organizations in society – “*how will fire fighters, police men etc. get to work?*” – but they never check anything in the game about this and do not do anything about this in this game-turn.

The second strategy, *monitoring*, is when participants check the current affairs of the simulation game. Examples of this strategy are when participants check how many guards they can locate to the stores, check the food supplies of different stores or check if the ATMs are empty etc.

The third strategy, *controlling*, is when participants performed an action (implemented the action) to prevent chaos in the simulation game. For example, by providing societal updates of the crisis by radio, by raising the amount of guards in the stores, or by opening up swish and invoice as valid payment options in stores.

The fourth and final strategy, *self-monitoring*, is when participants self-criticize and modify the actions the team previously performed. An example from this study is: “*when did we put in the max amount of withdrawal of 2000kr (referring to the game before)? Maybe that was too early to do?*”
6 Discussion

This chapter will discuss the result and the method, but will also include some of my own reflections about the TRAMS protocol as well as some recommendations for the TRAMS protocol.

6.1 Results

- How similar are the distributions of observed resilience strategies noted by the observers?

The distribution is very similar when looking at Table 3. The results indicate a good agreement between the observers in the data collections. However, the involved observers make their observations subjectively, so the observer plays an important role in how the observations may be connected to the strategies: some differences that can be seen is that observer B made one observation in learning. This strategy is not counted since only one observer observed this, and as a rule there must be at least two observers that observe it to be counted. Furthermore, the strategy self-monitoring was also observed, but only by observer B and C, and a very small amount, 1% of the observation was observed in this strategy. So, while this strategy can be found during the games, it is not common. The same with monitoring, which is not a common strategy in the game since the participants do not use the simulation games as much as the project wanted, but all observers observed this at least once. Most of the observations could be found in the strategy anticipation. This is not strange since a huge amount of the time in the game is focused on the discussion the team have before they implement anything in the simulation. The strategy controlling is the second where the most observations where found. This because all the implementations the participants do in the simulation are written down here. However, it is not clear why the distribution look like this in the simulation games. There are two main hypotheses: 1) the participants simply forgot to ask the simulation manager about how the actual state in the simulation is (monitoring), because they are so engaged in their discussion about how to handle the situation (anticipation); 2) the participants are asked to make decisions of actions at certain points in the game (days 1, 2, 4, 6 and 8), which create a situation where the participants maybe consider that as not necessary to ask for more information between these decision points, so maybe the current game design is not ideal to assess this.
- What strategies from the TRAMS protocol were found during the data collections?

Four of the six strategies have been found in the data. The strategies anticipation, monitoring, self-monitoring, and controlling were found. However, the strategies learning, and recovery were not found.

The fact that only four categories of strategies relating to the six core resilience functions were found in the simulation games is interesting, and there can be several reasons why. It may be due to limitations of the simulation game, the participants or other factors. Furthermore, since participants did not have time to train enough this can affect the result. Also, learning and recovery may not be visible during the games themselves, but it does not mean that these strategies cannot be found just because it was not seen in this data collection.

- What themes within the strategies noted when using the observation protocol could be found?

Results of the thematic analysis identified eight themes in the collected data. The themes were:

- Coordinate and collaborate
- Payment options
- Cash circulation
- Fuel and transportation
- Safety
- Inform, communicate and the media
- Hoarding and rationing
- Vulnerable groups

The majority of the findings was from the strategies anticipation and controlling. The themes represent what has been said and which actions were implemented during the games. In looking at Table 4, it is clear that some themes were more common than others in the data. However, the themes have been found in almost all the simulations games, or have at least been mentioned. The themes found in the data recur, but why is it that they do? One speculation for why is that it has something with the team composition. There are different representations from society in the team, and they probably have different experiences and knowledge about crisis situations and card payments. This will affect the discussion and which direction the team will go in their speculations and reasonings. Maybe that is why some themes are more common than others. However, many themes recur in all the teams discussion and this is probably
because these aspects are important and an obvious problem that the society will try and manage in a situation where the card payments stops working.

- Are similar observations made between the observers?

An interesting part is not only to see how similar the distribution in strategies the observers has made but also how similar these observations are. When looking at data there are a lot of similarities, but some differences as well. The reason for this is that the observers make subjective observations, they interpret what they hear, or they hear different things. Maybe the concentration differs in the game sometimes or some observers are faster writers than others. There are probably many different reasons why the result is like it is. Therefore, it is important to have audio recordings as support and to have some discussion with the other observers before and after simulation games so that they all are approximately on the same page in how to use TRAMS and how to interpret things. However, when you look at the data in the TRAMS protocol are the observations similar which hopefully indicates that the protocol can be used as a research tool in the future.

6.2 Method

The method used in this study is observation protocol and thematic analysis. The observation protocol used in this study was TRAMS. The protocol is based on resilience theory, through which strategies in how the teams in the simulation games manage disruption are observed. An advantage with using this sort of method is that it enables a direct observation of behaviour. That is why this method is used, since for example, survey studies cannot enable this direct observation of behaviour and are more of a conclusion about the behaviour that is based on the respondents’ statements. In addition, according to McCall (1984), observation protocols, compared to interviews and questionnaires, are powerful tools and better suited for social interactions and organizations like the simulation games in this project. However, there can be disadvantages with the use of observation protocol – it sometimes requires a certain amount of interpretation from the observer. According to Bryman (2001), guidelines are needed to interpret. A number of guidelines were developed for the TRAMS protocol, and some “rules” in how to use it agreed upon. Discussions after the games between observer in how to interpret observations were also conducted. According to McCall (1984), observation methods provides four advantages that can be read in this thesis under “observation protocol”, which gives a strong support for the choice of observation protocol. Furthermore, another struggle with observation protocols can be reliability and validity, which needs to be considered.
The method thematic analysis has been used to analyze the collected data. Since the thematic analysis method finds major themes in the qualitative data, this was an appropriate method to use to summarize the data. An advantage is that the data can be described in depth. It is also important that the analyst has an intimate knowledge of the data, which in this case the analyst has. Since this study also want to try to describe in depth what is happening in the data, thematic analysis is suited for this, according to Howitt (2010). In addition, the identified themes represent the central aspects of the data, which is what Braun and Clarke (2006) means count as a theme.

The methods have been good to use in this study to access the most important parts of the data. Maybe some other methods could have been used but within this time frame are the methods used not unreasonable. This study is limited within a frame of the CRRAAAFFTTING project and with a comprehensive data collection, so the use of something else can be difficult. Instead of using thematic analysis maybe an evaluation of the protocol in a more structured way could be done, or more workshops with the observes. The methodology could maybe be more of a design method with workshops were different aspects are discussed. An option could be to collect all data before the discussions are made. But within the time frame and the frame of the project these methods were the most reasonable methods to use.

6.3 My own reflections and modifications of TRAMS protocol

Results found from the data made it clear that some conclusion can be drawn. The strategies anticipation, monitoring, controlling, and self-monitoring could be found during the games, the observers have a very similar distribution of observed strategies, and the observations that are made are similar in content. However, the game layout can be improved. At the moment, the simulator is not used as much as it could be, the participants make many assumptions instead of checking the simulator. This is a problem that needs to change as it also suppresses monitoring strategies. Instead, the design of the simulation should be improved so that the participants will use the simulation games more and interact with it, then make their own assumptions. In addition, many teams discussed the situation during breaks when the game is not played, which can probably affect how the games are played too.
It is recommended to have at least two observers using the TRAMS protocol, so that they can compare the outcome with each other. For a note taker to be alone, it requires both experience in identifying the strategies and in note taking. In addition, in some games it can be difficult to correctly assess what is happening, especially when there are parallel discussions in the team. In such cases, the note taker may have to use the audio recordings and go back and listen to what actually was discussed. Therefore, audio recordings are very important, both to support note taking but also to verify observation.

- **How can the design of the TRAMS protocol be improved?**

The design of the TRAMS protocol needs some improvements. At the moment, it is difficult to find time to write every column in the protocol during the simulation games. The columns for the “SyRes functions”, “developed by”, and “effects” (if they can be assessed) are the ones that an observer manage to fill in real time. A design improvement that can be implemented to help the problem with not having time to fill in everything in real time, is dropdown menus. Among others, the columns “affected by”, “developed by”, “actors” etc. could have a dropdown menu, since there are existing data on what options that can be filled in there.

Furthermore, a column for notes or comments needs to be added, so the observers can note if something is special in the game or if something is changed. For example, one team got the information that it was a holiday week when the card payments stopped working. The column “core values” was removed as it was deemed too difficult to judge what the core values actually were.

- **What guidelines are needed to help the observers use the TRAMS protocol in the same way?**

Guidelines are very important to have when filling in the TRAMS protocol, both so that the observer fill in the protocol in similar ways but also so that researchers that have never used the protocol can use it. The guidelines presented in the result section is a good explanation with many examples how to fill it in and how each strategy can be interpreted.

Guidelines that are needed are that only strategies noted by two or more observers can be counted as a found strategy, and that two observations should be noted in separate lines to avoid mismatches. Why a strategy only was counted if two observers found it, was because an
agreement between the observers that if only one saw the strategy there is a possibility that this strategy was not found.

6.4 Future research

The TRAMS protocol is still under construction and improvements are needed. The TRAMS protocol will continuously develop within the next 15 simulation games that will be conducted. Hopefully, the TRAMS protocol will mature into an applicable research tool. Therefore, more development needs to be done to validate it. In addition, an important part in the game is to get the participants more active and to use the simulator, so that more strategies than anticipation and controlling can be focused on.
7 Conclusions

- TRAMS can enable observations in order to assess the resilience strategies used by the teams to cope with the disruption in the simulation game.
- Applying the TRAMS instrument is needed to deliver feedback to the participants as well as to simulation-game designers.
- Observers note down observations in a similar way in the strategies, so the distribution is: majority of observation in anticipation, then controlling, then monitoring, and last self-monitoring.
- The observations noted by the observers were similar.
- Strategies that could not be found in these data collection were learning and recovery.
- Identified strategies developed by the simulation game participants related to the core resilience functions. It is useful for increasing the understanding about what the focus of the simulation games should be – preparation, monitoring, response etc.
- There were eight themes that were found in the data: “coordinate and collaborate”, “payment options”, “cash circulation”, “fuel and transportation”, “safety”, “inform, communicate and the media”, “hoarding and rationing”, and “vulnerable groups”.
- The initial results from the use of the TRAMS protocol helped the creation of examples and guidelines for the strategies anticipation, monitoring, controlling, and self-monitoring.
- The TRAMS protocol has not been fully developed yet; new columns would need to be added and existing ones would need to be removed before it can get validated.
- The TRAMS protocol still needs improvements and should continuously be developed within the next 15 simulation games that are planned in the project, so that it can be validated and used as a research instrument.

7.1 Recommendations

The following are several recommendations for the TRAMS protocol, which is conclusions drawn from the results:

- To have at least two observers using the TRAMS protocol.
- To use audio recordings in order to support the note-taking.
- To add dropdown menus in the protocol to support real time note taking.
- To add a column for additional comments.
• To ensure that only when at least two observers note down a strategy it can be considered as a found strategy.
• To note each observation in one line.
8 References


