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Cascading Scenario Technique Enabling Automated And Situation-based Crisis Management

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Abstract

Crises are becoming more and more frequent. Whether natural disasters, economic crises, political events, or a pandemic - the right action mitigates the impact. The PAIRS project plans to minimize the surprise effect of these and to recommend appropriate actions based on data using artificial intelligence (AI).
This paper conceptualizes a cascading model based on scenario technique, which acts as the basic approach in the project. The long-term discipline of scenario technique is integrated into the discipline of crisis management to enable short-term and continuous crises management in an automated manner. For this purpose, a practical crisis definition is given and interpreted as a process. Then, a cascading model is derived in which crises are continuously thought through using the scenario technique and three types of observations are classified: Incidents, disturbances, and crises. The presented model is exemplified within a non-technical application of a use case in the context of humanitarian logistics and the COVID-19 pandemic. Furthermore, first technical insights from the field of AI are given in the form of a semantic description composing a knowledge graph. In summary, a conceptual model is presented to enable situation-based crisis management with automated scenario generation by combining the two disciplines of crisis management with scenario technique.

Keywords

Crisis Management; Supply Chain; Humanitarian Logistics; Scenario Technique; Scenario Pattern; Operations Planning; Resource deployment; Knowledge Representation

1. Introduction

Since 2020, the cascading effects of global crises are more perceptible as ever before. As the COVID-19 pandemic unfolded, actors in all sectors all over the world could observe as the implications of the pandemic rippled across all domains down into the everyday life of citizen. Originally being a medical domain topic, the pandemic for instance very quickly influenced air traffic due to global restrictions on international mobility. This effect alone caused large implications on the global labor market, tourism sector and caused major supply chain disruptions [1]. Besides the economic impact, the pandemic also had numerous political and social consequences. Amongst others the medical sector, education, digitization, ways of working and the cultural sector underwent major shifts and triggered interdependencies and long-term implications which are not all yet apparent. In this complexity, it becomes increasingly difficult for affected groups and actors to keep track of available information and to differentiate between relevant and irrelevant information. Methods to reduce complexity are needed and to decide on expedient actions to anticipate and minimize the effects of crises regarding their individual situation.

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In the PAIRS (Privacy-Aware, Intelligent and Resilient crisiS Management) research project, a scenario-based crisis management platform is being developed in which hybrid AI methods are used to detect and anticipate the development of crises and to identify adequate measures for each actor.

In this paper, a concept for cascading scenario technique is presented and applied to one of the project's use cases in the field of humanitarian logistics. Existing crisis management research and scenario technique are highlighted as the underlying approach to enable situation-based crisis management with automated scenario generation. First technical insights are given on how to use the model within the development of a service for operations planning of the German Federal Agency for Technical Relief (German abbr. 'THW'), an organization that acts upon crisis scenarios. We thereby apply a knowledge representation of THW's operations in the form of a semantical description that enables to create a knowledge graph serving as foundation for further technical approaches (e.g., machine learning, planning methods) in order to generate actions and planning recommendations.

2. Fundamentals of scenario technique

For long-term strategic planning, institutions use the scenario technique to make a socio-economic forecast and take appropriate preparatory measures [2–4]. The aim of the scenario technique is the generation of several scenarios (cf. Figure 1). Each of these scenarios is intended to show hypothetical consequences to draw attention to possible decision-making processes of the actors concerned [2,4].

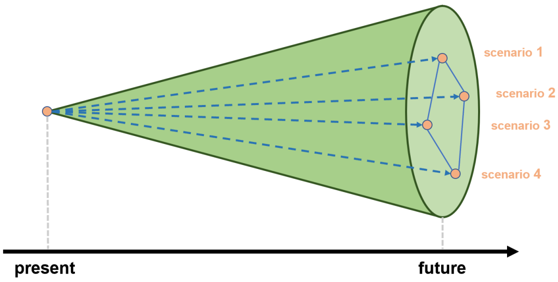


Figure 1: A scenario funnel projecting 4 different scenarios from a particular starting point

A scenario can be seen as a bundle of the most diverse characteristics of the influencing factors. The characteristics of an influencing factor can be interpreted as a spectrum between best/worst cases, which increases in magnitude on a scale like a funnel over time. This phenomenon of drifting apart of the best/worst cases is called scenario funnel. Once a wide variety of scenarios have been modelled, cluster analyses and plausibility checks are used to assess the probability of occurrence of the scenarios. A good result from a scenario analysis is not one that shows a high density and overlap with respect to other scenarios in a space. Rather, outliers should be identified as interesting cases and further examined to see how they can be controlled with decisions made by the actors. It should be emphasised that a larger number of scenarios leads to a better result but is also associated with greater effort. [2–6]

3. Related work to scenario technique in crisis management

To demonstrate the potential of continuous and automated scenario generation in crisis management, a literature review was conducted to identify the status of the use and degree of automation of scenario technology in crisis management. Aspects as the general time horizon of predictions with scenario technique and software for automated scenario generation are analyzed.

3.1 Time horizon of prediction using scenario technique

Up to now, the scenario technique is mainly used for strategy planning, which is an iterative process in business area [3]. The methods are generated in scenario projects to help strategy development. This process is designed to make a forecast from day X of the project. The time period of the forecast varies but is between 5-15 years [3,4,7]. The recommendations for action refer to an implementation solution, the realisation of which take at least 3 years. It can be seen that the timeline of the scenario generation is chosen very wide and is not observed in the short term. Study [8] analyzes the application of scenario technology in the real economy. They surveyed almost 300 companies with annual sales of more than 250 million euros. Results show 70% of the interviewed companies not using scenario techniques with a concrete plan of action for possible scenarios.

3.2 Software tools for scenario generation

Nowadays, software solutions are used to help generating scenarios. Big players are presented in the following section.

Inka 4 [9] is a software solution, which is very close to the process of scenario technique described above. The methodology is based on a consistency matrix analysis in which scenarios are formed through independent weighting and selection of the influencing factors. However, the software solution represents little to hardly any automation, let alone AI. In addition, the program is very limited in its accuracy by the data fed in by the actors themselves. Reaction measures are also left out, which ultimately offers relatively little added value for the user.

The Scenario Manager from ScMI [10] is a software solution that generates scenarios for an initially defined environment. It focuses strongly on key factors that are selected in a consortium. With the help of these factors, projections and development possibilities are presented, which should generate a landscape of scenarios through a consensus evaluation. The solution uses an automated instance to delineate core dimensions of the scenarios. However, this product only focuses on core dimensions determined from key factors. It lacks a large database that raises external trends, unless the user identifies these.

3.3 Software tools for crisis management

Available risk assessment and management software solutions tend to function in isolation. Even the functionality of "supply chain risk management" (SCRM) tools, such as, SAP Ariba [11] and Resilinc [12], is limited as they mainly use data from internal company systems for their analyses. Resilinc is a supply chain specialized company with software solutions focused on risk analysis. The resilience assessment is based on the data without AI. The focus here is strongly on the processing and visualization of the collected data. Resilinc does not base its crisis management on the scenario technique, but simply establishes the probability of suppliers being affected by certain events, which then have an impact on their own supply chain. Other tools, such as DHL Resilience 360 [13], can pull data from various sources to identify supply chain disruptions; however, these are usually focused on logistics metrics without any further utilization (e.g., capacity of affected companies). Traditional methods such as crisis management [14], risk management [15] and security management (e.g., probabilistic risk assessment (PRA)) are used. Projects that offer a holistic overview of the situation usually require the engagement of specialized consulting firms. The resulting long response time would preclude such an approach within a crisis.

Strategic scenario planning has not yet been integrated into crisis management, so that different crisis scenarios based on cross-company data along the value chain have not yet been generated on a situational and continuous basis. This means that one of the most important aspects for crisis management, collaboration along the supply chain, is not ensured [16].

3.4 Summary

Scenario technique is used in strategic planning with a wide timeline. The proportion of automation in these software solutions is low, especially in the sections of the scenario field analysis, and is associated with a high level of effort for the user. There is no possibility to generate new scenarios automatically based on already created scenarios. Moreover, scenario technique is not used in crisis management yet, so that there is no possibility to generate new scenarios on situational and continuous basis. Therefore, it is necessary to investigate a solution that results in a continuous crisis management through the permanent cycle of scenario generation to enable the generation of situational basis. The needed concept for this solution is presented in the following.

4. Cascading model on scenario technique for continuous crises management

For the continuous anticipation of crises, a continuous model is developed, which is based on the fundamentals of scenario technique. The goal is to enhance the one-time planning with looping scenario technique, e.g., in strategy departments, by continuously generating new and dependent scenarios.

The basis for this is the concept of resilience specifically in crises. The goal is to return to a stable state in which the ability to act is made possible [17]. As described by STICH ET AL. [17], in the disturbance curve of performance, it can be seen how an unstable state at the beginning develops immediate consequences. The affected actors differ depending on the maturity of the crisis: First, the consequences are felt in the direct circle of the individual affected, also called a micro crisis (e.g., a corporate crisis). If this crisis affects multiple actors and has many interdependencies, then it is called a macro crisis (e.g., economic crisis).

Both classes of crisis arise from a chain of events and can be interpreted as a process (cf. Figure 2).

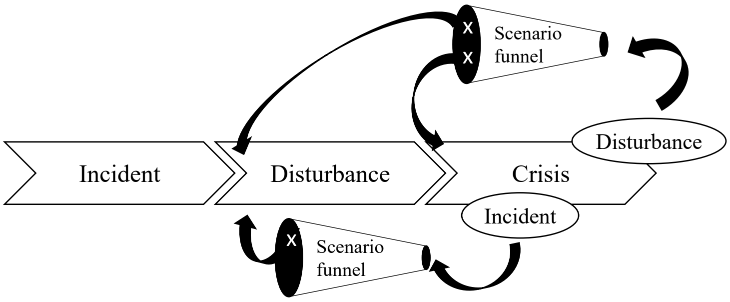


Figure 2: Looping scenario technique based on the 3-step process of crises.

Based on the interpretation of STICH ET AL. [17] and BSI [18], this means that crises are motivated by *incidents* which grow to *disturbances* leading to *crises*. Thereby, *incidents* are events of any kind, which do not lead to a deviation from the normal state. *Disturbances* are unplanned and unforeseeable deviations from a planned course or condition. *Crises* are a continuing, varying degree of deviation from the normal state of things. It can have various causes with specific unavoidable consequences. In principle, the effects of crises can only be influenced to a limited extent since the outcome is influenced by the actions of all actors. The aim of countermeasures is to return to a permanent stable state and thus secure essential processes and the continued existence of the system.

Using the existing scenario technique, the two concepts of the 3-step process of crises as well as the scenario technique can be mapped together. This means, that the generation of a new scenario can start in any of the listed stages of the 3-step process of crises (cf. Figure 2). In other words, every event (incident, disturbance, crisis) in each stage can be used as an input for the one-time generation of multiple scenarios so that the output results in a later state, e.g., an incident as input to the scenario funnel results in two scenarios which outputs a disturbance and another one a crisis (cf. Figure 2 upper funnel).

The model presented here is intended to allow this one-time starting in the phases continuously, so that a chain of incidents, disturbances and crises can be integrated in the generation of the scenarios. This creates a loop in the generation of scenarios (cf. Figure 2). We describe this model as cascading.

Exemplified, Figure 2 shows an incident developing to a disturbance and afterwards to a crisis (main process arrow). In that crisis again new events happen (labeled ovals) which are interpreted in this example as a possible disturbance and an incident (bubbles next to crisis). Based on each of this disturbance and incident, the scenario technique (scenario funnel) is used to generate new and multiple scenarios. For example, the upper disturbance in Figure 2 leads again to a possible disturbance or/ and to a crisis.
Essential here is that the output of the scenario funnel (i.e., one of multiple scenario) can contribute directly as an incident, disruption, or crisis, depending on its magnitude. In other words, this is the impact of the event on the scenario generation. For example, every occurring incident in a crisis can be interpreted as a new input for the generation (cf. Figure 2).

This loop breaks the singularity in the scenario planning. Each occurring result (output of the scenario generation) acts again as an input. This continuity can be represented and interpreted as a tree (cf. righthand side in Figure).

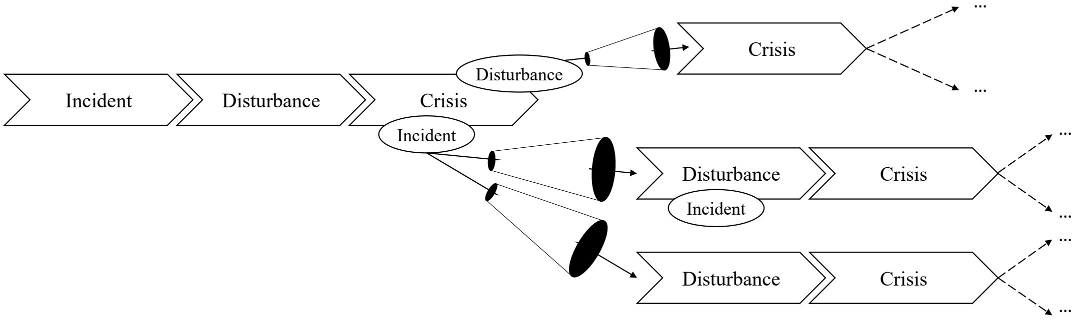


Figure 3: Looping scenario technique based on the 3-step process of crises illustrated in a tree diagram

In Figure , the process arrows indicate the development of e.g., an incident to a disturbance, whereas a simple arrow with funnel shows the application of the scenario technique to generate new scenarios, in which a new process evolves.

This overall looping corresponds to the underlying idea of the PAIRS research project. Each branch (cf. 3-step crisis as process) is a new event or a different interpretation of it for e.g., another group of actors, so that crises can also be generated, considered, and analyzed across different actors.

5. Application

The German Federal Agency for Technical Relief (German abbr. 'THW') acts upon mentioned crisis scenarios (e.g., floods, Ukrainian war, pandemics). As agency of the German Federal Ministry of the Interior and Community, responsibilities of the THW include technical assistance in civil protection, in disaster relief, public emergencies as well as major accidents nationally and internationally [19]. In collaboration with the THW, the PAIRS project specified a humanitarian logistics use case in order to support daily operations at the THW by means of AI.

In the following the humanitarian logistics use case is described. Thereby, the COVID-19 crisis is used as a concretisation of the use case to illustrate the non-technical application (cf. 5.2) of the cascading model, which is the first step for explanation of a crisis. Section 5.3 then transfers the COVID-19 example into a semantic description via a technical mapping, that enables an AI-based operations planning approach in the future.

5.1 Use Case description: Operations Planning

The personnel infrastructure of the THW consists of 80,000 volunteers and 2000 full-time employees working in 668 local sections, modular units are deployed in a flexible manner in real-time [19]. The operational options catalogue of the THW includes hazards and requirements due to natural disasters, transport accidents, or other occurrences concerning civil safety [20]. Additionally, the THW's domestic operations include logistics-related options, i.e., emergency supply of communities with critical and daily needed resources, setting up and operating logistic bases and the emergency repair or maintenance of critical infrastructures (e.g., electricity, sewage disposal, supply of fuel or drinking water). Missions also include other logistic related tasks as the transport of resources used for construction and technical support of emergency shelters or catering for task forces [19][20]. In the context of a crisis, resources need to be delivered as soon as possible for humanitarian reasons. Therefore, the resource delivery needs to be optimized. As every task and operation is different, the allocation of staff including the mapping of special capabilities poses an additional challenge. Operations must be characterised according to (1) tactical units required, (2) time horizon, (3) the assumed duration of the operation, and (4) required resources (e.g., vehicles, technical devices, consumables, other operational resources). Depending on scope, severity and urgency of the operation, planning and design is performed manually by local associations, national associations or the THW’s headquarter. A manual assignment of personnel, tasks, resources, and logistics cannot always be carried out in the most efficient manner. Supporting THW's operations with an AI-based approach therefore reduces time and costs for all participants within the planning process.

5.2 Non-technical application of the cascading scenario model

To illustrate cascading scenarios within an unfolding crisis from THW perspective, the model is exemplified based on the COVID-19 pandemic. It will be evident, how the model can be used as a useful analysis tool to extricate single strings of the crisis and to pinpoint options for action in a multicausal, dynamic and complex situation. For this purpose, few iterations of the 3-step process will be singled out in a narrating manner, visualised in Figure .

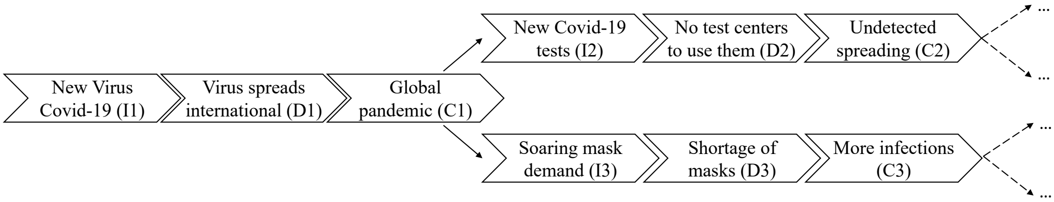


Figure 4: Exemplified cascading crisis model in the THW use case.

In late 2019, a new coronavirus named COVID-19 emerges (*incident I1*). The virus spreads internationally infecting people (*disturbance D1*), turning into a global pandemic (*crisis C1*). Deriving from this, new branches of the crisis can be followed. One branch describes the development of new COVID-19 tests (*incident I2*) to contain the spreading of the virus. These first tests can only be used by professionals in testing centres, for which the infrastructure is missing (*disturbance D2*). Missing test centres have the effect, that the spreading of the virus continues without being detected (*crisis C2*). Another branch deriving from the first iteration describes a soaring demand of hygienic protective equipment like masks, gloves or sanitiser (*incident I3*). We will focus here on masks as an example. This sudden rise in the mask demand is followed by a mask shortage (*disturbance D3*) which leads to more infections (*crisis C3*). Subsequently to *crisis C1* (pandemic) and *crisis C3* (more infections), the hospitalisation rate increases (*incident I4*) which leads into a shortage of hospital beds (*disturbance D4*). Without countermeasures, a shortage of hospital beds results into a rise of death cases (*crisis C4*). Following the shortage of masks, another branch includes the sudden procurement of large quantities of masks by the government (*incident I5*). But without a fitting infrastructure to distribute them quickly (*disturbance D5*), the result once again is more infections (*crisis C5*).

Applying the cascading scenario model in this manner from the perspective of one actor in the crisis, the actor can pinpoint the critical points of action they can take. In this example, the THW can systematically analyse with which of their operational options they can influence which disturbances to not turn into crises or to reduce the impact of the crisis. In this case, the operational options of the THW allow to take actions as operating central logistics centres to distribute protective equipment and to build an infrastructure distributing them to regional focal points (*disturbance D5*). Further actions include building new test centres (*disturbance D2*) and the support in distributing hospitalised patients to hospitals with free capacities (*disturbance D4*).

5.3 Technical transfer of the cascading scenario model

The goal in THW use case is to develop a service generating planning and design recommendations for THW's operations supported by AI. One approach that serves as basis for the development of such a service can be found in previous research. AISOP thereby conceptualizes a model for AI-based scenario planning within crisis management that is instantiated within the energy domain [21]. AISOP uses four essential components to (1) describe and learn, (2) anticipate, (3) monitor and (4) respond to occurring crises events. For the first component, the model uses semantically enhanced Scenario Patterns that provide detailed background information on crisis scenarios, in particular information on crisis identifier, context, location, reason, the impact of the event, potential actors, measures, used resources, data sources and historical events [21]. The model proposes to link interrelated historical crisis situations using JSON-LD, which then serves as basis for applying further methods (e.g., predictive analytics), on the resulting knowledge graph network of historical crisis scenarios [27].

By applying the general idea of a cascading crisis as exemplified in chapter 5.2 on a technical processable semantic description such as Scenario Patterns, we lay the foundation for applying AI to our logistics-driven use case. Cascading crisis scenarios and their tree like structure are therefore transferred and represented within a respective knowledge graph network. Incidents, disturbances, and crisis events (cf. Figure 2) each represent a scenario described by filled Scenario Patterns. The resulting knowledge graph (cf. Figure 5) can be used to run analytical operations, e.g., to identify critical scenarios within the graph interlinking to many subsequent events.

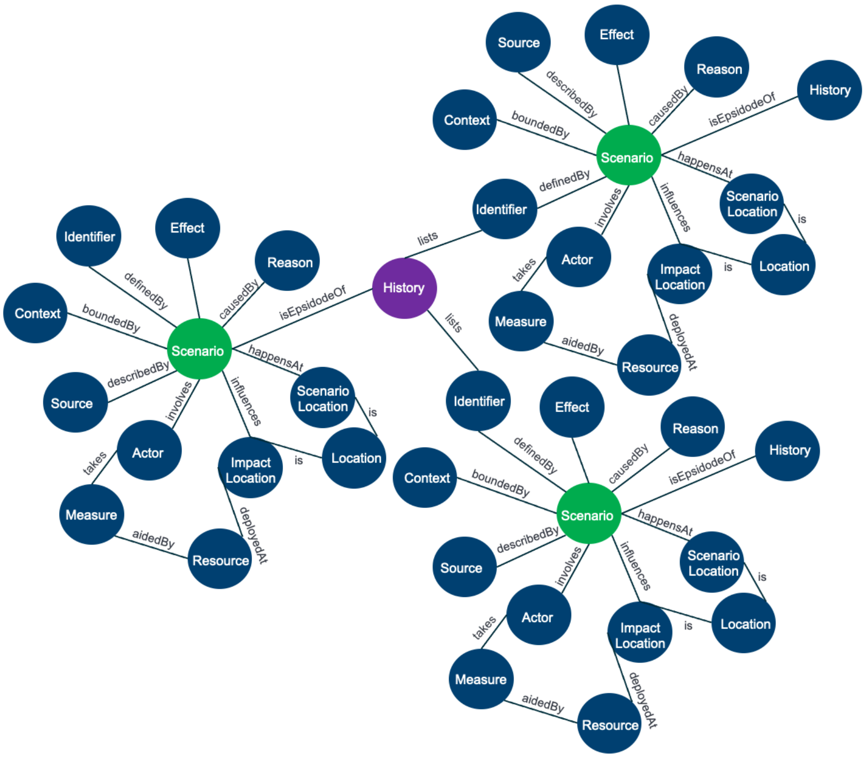


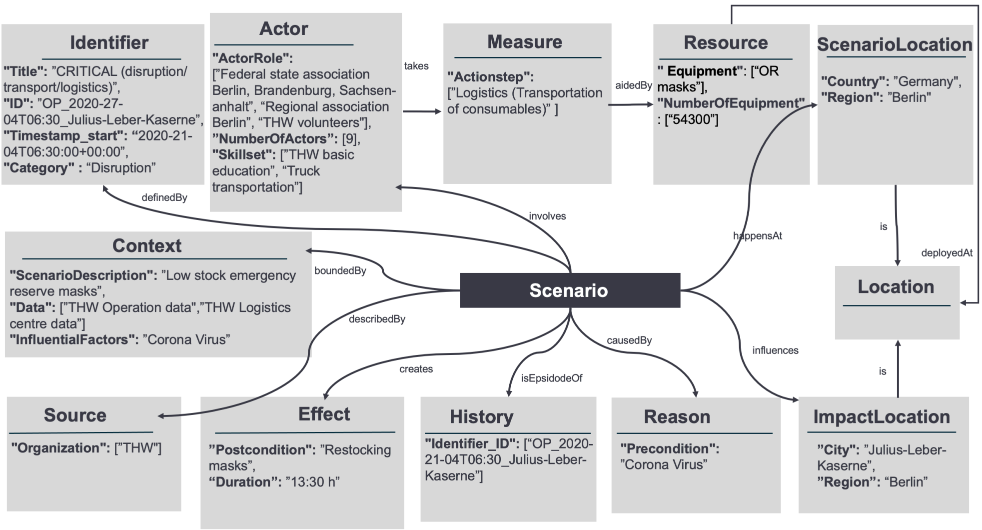
Figure 5: Exemplified Knowledge Graph Instance of a cascading crisis

To generate Scenario Pattern instances operationalized in JSON-LD for an operations-based knowledge graph, we used historical THW operations within Germany between 2012 and 2022 as data basis, as well as historical data from THW's logistic centres. We matched the two datasets based on locations and date and mapped corresponding attributes within the data sets onto the entities of the Scenario Pattern. The following table (cf. Table 1) hereby shows an example for a mask shortage event, as described within disturbances D3 or D5 of section 5.2.

Table 1: Mapping of THW's data attributes onto the Scenario Pattern's structure

Scenario Pattern Entity	Attribute in Scenario Pattern	Mapping of data attributes by THW	Example
Identifier	Title, ID, Timestamp, Category	TypeOfEvent, * , Start	**"Title":** ” CRITICAL (disruption/transport/logistics)”, **"ID":** ”OP_2020-21-04T06:30_Julius-Leber-Kaserne“, **"Timestamp_start": “**2020-27-04T06:30:00+00:00”, **" Category ":** “Disruption”
Context	ScenarioDescription, Data, InfluentialFactors	Description, *, *	**"ScenarioDescription":** ”Low stock emergency reserve masks “, **"Data":** [”THW Operation data", ”THW Logistics centre data”], **"InfluentialFactors":** ”Corona Virus”
Source	Organization	*	**"Organization":** [”THW"]
ScenarioLocation	Country, Region	Country, Federal state	**"Country":** ”Germany”, **"Region":** ”Berlin”
ImpactLocation	City, Region	City, District	**"City":** ” Julius-Leber-Kaserne”, **"Region":** “Berlin”
Reason	Precondition	Service Project	**"Precondition":** ”Corona Virus”
Effect	Postcondition, Duration	Task, Duration	**"Postcondition":** ”Restocking masks“, **"Duration":** ”13:30 h”
Actor	ActorRole, NumberOfActors, Skillset	Federal state association, Regional association, NumberOfActors, *	**"ActorRole":** [”Federal state association Berlin, Brandenburg, Sachsen-Anhalt”, “Regional association Berlin”, “THW volunteers”], **"NumberOfActors":** [9],**"Skillset":** [”THW basic education”, “Truck transportation”]
Measure	Actionstep	Task	**"Actionstep":** [”Logistics (Transportation of consumables)”]
Resource	Equipment, NumberOfEquipment	ORMasks	"**Equipment**":[“OR masks”], "**NumberOfEquipment**": [“54300”]
History	Identifier_ID	*	**"Identifier_ID":** [“ OP_2020-21-04T06:30_Julius-Leber-Kaserne”]

We added the *Category* attribute within the Scenario Pattern entity *Identifier* to categorize the scenario accordingly to our cascading model. The categorization can be automatically filled based on number of subsequent events within the resulting knowledge graph network. Attributes within the Scenario Pattern for which no mapping to THW’s data exists (highlighted with *), can also be filled in an automized manner (e.g., Identifier.ID, History.Identifier_ID), or based on statical input (Source). The filled Scenario Pattern’s structure can be seen in Figure 6. In the future, we are planning to use cascading crisis scenarios as presented by applying further related research on the resulting operations-based knowledge graph. Apart from works that apply predictive analytics [21] or inductive knowledge [23,22] on knowledge graph networks, we are also considering graph-analysis [24] and planning-based approaches [25] in order to generate appropriate planning and action recommendations for THW.



Identifier
"Title": "CRITICAL (disruption/ transport/logistics)",
"ID": "OP_2020-27-04T06:30_Julius-Leber-Kaserne",
"Timestamp_start": "2020-21-04T06:30:00+00:00",
"Category" : "Disruption"

Actor
"ActorRole": ["Federal state association Berlin, Brandenburg, Sachsen-anhalt", "Regional association Berlin", "THW volunteers"],
"NumberOfActors": [9],
"Skillset": ["THW basic education", "Truck transportation"]

Measure
"Actionstep": ["Logistics (Transportation of consumables)"]

Resource
" Equipment": ["OR masks"],
"NumberOfEquipment" : ["54300"]

ScenarioLocation
"Country": "Germany",
"Region": "Berlin"

Context
"ScenarioDescription": "Low stock emergency reserve masks",
"Data": ["THW Operation data","THW Logistics centre data"]
"InfluentialFactors": "Corona Virus"

Source
"Organization": ["THW"]

Effect
"Postcondition": "Restocking masks",
"Duration": "13:30 h"

History
"Identifier_ID": ["OP_2020-21-04T06:30_Julius-Leber-Kaserne"]

Reason
"Precondition": "Corona Virus"

ImpactLocation
"City": "Julius-Leber-Kaserne",
"Region": "Berlin"

Figure 6: Filled Scenario Pattern structure based on THW data

6. Conclusion

In this paper, we expand the unique singularity in scenario generation. For this purpose, the scenario technique was applied to a crisis generation process to generate events, disturbances as well as crises continuously and interdependently for different affected actors. This is done in a cascading manner in the form of a loop, where in every iteration scenario technique is applied. Furthermore, a crisis tree with influences can be generated by the dependency, which supports the visualization. Moreover, we transferred these trees into a first technical approach to semantically describe cascading crisis scenarios within the structure of Scenario Patterns using JSON-LD and laid the foundation to apply an AI-supported scenario planning approach. In the future, we plan to use the resulting operations-based knowledge graph to develop a service that supports THW's Operation Planning by generating planning recommendations and to realize it within a proof of concept.

The presented concept of cascading crises enables a deeper understanding of crisis situations and further automatization regardless of the contextual industry. It serves as the underlying approach for automated industrial crisis management throughout the overall Supply-Chain in the context of PAIRS. Within this work we showed an application within the logistic context. The model and the applied semantical description within the Scenario Pattern enable a knowledge representation of information and data about crises, that can further be applied on data of various contexts also within the PAIRS project, such as investigated use cases in the energy or health domain. Resulting knowledge graph networks can be used as input for generating action and planning recommendations or for the prediction of crisis events.

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Biography

Stefan Leachu (*1996) is a researcher at FIR at the Institute for Industrial Management RWTH Aachen University in the department of Information Management since 2021. With his degree in computer science, he enjoys linking the technical issues of various technologies with the value-added potential that can be achieved in the business world.

Jokim Janßen (*1993) works as a project manager and scientific assistant at the Institute for Industrial Management (FIR) at the RWTH Aachen since 2019. Before that, he gained experience in supply chain management at Miele & Cie. KG. In his current work as the group leader in supply chain management, he is managing projects in the context of digitalized supply chain management in research, consortia, and consulting projects.

Merlit Kirchhöfer (*1992) works as a research associate at the German Federal Agency for Technical Relief (THW) since 2021. As part of her degree in intercultural human resources management and communication management at Friedrich-Schiller University in Jena, she focused on organizational and work psychology. Her master thesis examined team resilience in the context of preparing hospitals for crisis situations.

Natalie Gdanitz (*1995) is a junior researcher at the German Research Center for Artificial Intelligence Saarbrücken with a degree in Business Informatics. While working at the department Smart Service Engineering under the directorship of Prof. Dr.-Ing. Wolfgang Maass, she focuses on industry and business-related topics and their ontological representation within the semantic web.

Dr.-Ing. Sabine Janzen is senior researcher and deputy head of the research department Smart Service Engineering at the German Research Center for Artificial Intelligence (DFKI). During her PhD in computer science, she worked on natural language interfaces for mixed motive dialogues. Now, Sabine investigates solutions for systematically designing and developing smart service systems; in this context, her research interests are AI architectures, intelligent user interfaces and Responsible AI.

Prof. Dr.-Ing. Volker Stich (*1954) has been head of the Institute for Industrial Management (FIR) at the RWTH Aachen University since 1997. Prof. Dr.-Ing. Volker Stich worked for 10 years for the St. Gobain-Automotive Group and lead the management of European plant logistics. In addition, he was responsible for the worldwide coordination of future vehicle development projects.