

A Work Project, presented as part of the requirements for the Award of a Master's degree in Management from the Nova School of Business and Economics.

ARTIFICIAL INTELLIGENCE IN DECISION MAKING OF CRISIS

MANAGEMENT:

**ANALYZING POTENTIALS AND LIMITATIONS TO STRENGTHEN TOP
MANAGEMENT RESPONSES IN BUSINESS RESILIENCE**

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I Abstract

This study examines Artificial Intelligence (AI) in Crisis Management (CM), particularly in crisis detection, decision-making, strategy implementation, and learning. Using quantitative interviews and a systematic literature review, it assesses AI's effectiveness in CM under extreme conditions and its autonomy levels. The findings suggest AI's limited efficacy in severe crises, its varied potential in CM phases, and mixed results at the operational level. Although some AI applications are effective, human intervention remains crucial in crisis contexts. The research highlights the need for further exploration of AI's limitations, including data biases and the challenges of mimicking human interactions.

Key Words: Crisis Management, Artificial Intelligence Integration, Early Detection, Decision-Making, Strategic Implementation, Organizational Resilience, Applications, Extreme Crisis, Human Involvement

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V List of Abbreviation

AAR - After Action Reviews	Et al. - Et Alii
AGI - Artificial General Intelligence	GenAI - Generative AI
AHP - Analytic Hierarchy Process	Ibid. - Ebenda
AI - Artificial Intelligence	KPI - Key Performance Indicator
ANI - Artificial Narrow Intelligence	LLM - Large Language Models
ASI - Artificial Super Intelligence	ML - Machine Learning
CCT - Crisis Communication Team	NGO - Non-Governmental Organization
CM - Crisis Management	NLP - Natural Language Processing
CMT - Crisis Management Team	NN - Neuronal Networks
DL - Deep Learning	OL - Organizational Learning
E – Expert(s)	SI&C - Strategy Implementation and Control
ED&P - Early Detection and Preparation	PM - Project Management

1 Introduction

The imperative of CM in the corporate landscape has undergone significant growth. The increasing complexity and uncertainties associated with crises, compounded by their time-critical and severe consequences, have prompted a fundamental transformation in addressing them in today's globally interconnected world (cf. Boin and Lagadec 2000; Lagadec 2005). A recent global survey on crisis and corporate resilience conducted by PwC ("The Resilience Revolution" 2023) revealed that 89 percent of companies prioritize resilience among their top strategic organizational goals, highlighting the growing relevance of CM.

In the face of the inherent complexity of crises occurring in diverse settings, which exhibit varied characteristics and effects and are challenging to predict, preventive measures become indispensable for the continued existence and protection of the companies. Technological progress should be utilized to detect crises early and identify suitable strategic measures for CM within the different phases of crisis occurrence.

One key driver in technological improvement to progressively enhance CM is the pivotal role of Artificial Intelligence (AI), which has emerged as a significant contributor to effectively managing corporate crises (cf. Benaben et al. 2020; Biswas and Chen 2021; Fischer et al. 2020; Murayama and Sakurai 2019). Previous research models have demonstrated the crucial role of data-based metrics and measurement tools in restoring a company's resilience, preventing future disasters, and monitoring its flexibility (cf. Bharatiya, 2023; Daviso and Sun, 2020).

Furthermore, employees anticipate AI's moderate to significant impact in the workplace and believe that AI-based platforms and tools can contribute to internal improvement (cf. "National Artificial Intelligence and Development Plan" 2023). Despite the challenges posed by the integration of technical software, with careful selection of its use, AI holds the potential to make a significant contribution to the resilience of organizations in an uncertain world (cf. El-Said et al. 2022; Farrokhi et al. 2020; Wut et al. 2021).

Regardless of some studies demonstrating successful AI applications in CM, there remains an inadequate exploration of AI's influence in corporate crisis research.

The missing in-depth analysis marks the entry point for the current study, which centers on addressing the overriding research question:

Can the integration of AI in CM contribute to improving a company's response to future crises and, in turn, fortify its resilience?

To address the research question, the study examines AI's potential in CM, thoroughly evaluating its effectiveness across diverse crises. It examines the degree of autonomy AI can reliably hold and the critical involvement of human oversight in completing tasks. Additionally, the study explores practical approaches to AI integration within CM processes. Finally, this study aims to provide applicable recommendations for effective CM in a business context.

2 Structure of Thesis

The thesis begins by laying the groundwork in Chapter 3.1, which introduces and defines key concepts such as 'crisis' and 'crisis management.' This foundation is further built upon with an in-depth presentation of crisis typologies in Chapter 3.2 and an exploration of the temporal and content-related aspects of crises in Chapters 3.2.1 and 3.2.2. The central theme in these chapters is to ascertain the potential role of AI in enhancing crisis readiness and assessment strategies.

Moving forward, Chapter 4 provides a comprehensive dive into the realm of AI. It begins with elucidating the definition of AI in Chapter 4.1, then progresses to discuss the various forms that AI can take in Chapter 4.2. Subsequently, the chapter addresses the advantages and risks associated with AI application in Chapter 4.3 and concludes with an examination of AI's current limitations and regulatory environment in Chapter 4.4, thereby aligning these discussions with the overarching research focus.

Chapter 5 extends the exploration to include additional findings that intersect AI and CM. This chapter not only investigates the synergy between these two domains but also seeks to identify gaps in existing research on crisis studies, from which concrete hypotheses are derived.

The methodology employed in the research is thoroughly detailed in Chapter 6. This chapter articulates the chosen qualitative research approach in Chapter 6.1, describes the utilization of narrative expert interviews in Chapter 6.2, and discusses the application of a qualitative content analysis framework for interview analysis in Chapter 6.3.

Chapter 7 delves into the potential application of AI in organizational CM. This chapter categorizes AI applications into various stages of CM, focusing on critical areas such as early detection and preparation (ED&P), decision-making, strategy implementation and control (SI&C), and organizational learning (OL). Each of these topics not only forms the core of this chapter but also represents distinct parts of the thesis. The chapter further includes a critical analysis of AI's applicability in extreme scenarios and the level of AI autonomy. The aim is to develop practical applications of AI for each identified phase of CM. Finally, the thesis culminates in Chapter 8, summarizing the findings and evaluating them against the defined hypotheses in Chapter 8.1. This chapter also discusses the limitations of AI applications and proposes future development areas to consider for AI applications, as outlined in Chapter 8.2. The study's limitations and future research directions are outlined in Chapter 9, guiding the progression of future research in this field.

3 Crisis Management

3.1 Crisis and Crisis Management Definition

The term “crisis” is exceptionally versatile and originates in Greek literature, where it is spoken of as a turning point (cf. Thießen 2011). Even in medical and military settings, the term “crisis” has a certain ambiguity, according to which a crisis can be decisive for life and death, victory or defeat (cf. Basel, Fichter and Keller 2018). Interestingly, in Chinese writing, the word used

to denote crisis can either refer to a *crisis* or an *opportunity*, which again illustrates the double-sided character of the term (cf. Siedschlag 2009). The term crisis is used in psychology, medicine, and the social sciences and, accordingly, psychosocial crises increasingly influence doctor-patient interactions in everyday medical life (cf. Matzer and Vajda 2017). In today's linguistic usage and through the (mostly) negative portrayals of current affairs disseminated by the news and mass media, a crisis is mainly associated with critical, unsuccessful, and catastrophic facts.

Dealing with crises is becoming increasingly relevant, especially in a business context. To remain competitive, companies must learn how to deal with crises and allocate the necessary resources to emerge from these stronger than before (cf. Drennan and McConnell 2006).

To break down the characteristics of a crisis more precisely, a crisis usually occurs unexpectedly. It is challenging to cope with, which means it can have a limiting and even existentially disrupting effect on businesses (cf. Krystek and Lentz 2014). Consequently, a crisis does not bring an unambiguous solution to a given problem, as it often takes an unintended and unplanned course (cf. Krystek and Moldenhauer 2007). Since the impact of crises is usually very high and also negatively charged, coping with them is generally urgent and associated with both time and personnel pressure (cf. Drennan and McConnell 2006). As the probability of a crisis tends to be low, there are gaps in preventive measures in the corporate context (cf. Carmeli and Schaubroeck 2008; Lockwood 2005), and hence corporate areas such as risk management and prevention measurements are becoming mandatory. An essential term in this context is *business resilience*. Organizational or business resilience describes the ability of a company to deal with constant and continuous challenges and to preventively develop processes, technologies, and employees for addressing crisis situations (cf. Dahles and Susilowati 2015). The aim is to create resilient companies and maintain stability by leveraging innovative technologies and employing qualified, skilled workers. However, a crisis does not

automatically have to entail a dangerous or existentially destructive outcome and can thus develop in various ways. Acknowledging that crises often have ramifications beyond individual companies and recognizing the increased emphasis on resource allocation during such times, proficient CM improves efficiency and opens up pathways for new development opportunities (cf. Garth 2008).

Crises are complex, diverse, and unique, making it challenging to create universal theories concerning them (cf. Bundy et al. 2017). While typically seen as unfavorable, depending on their type and impact, crises can also present opportunities for sustainable improvement. To differentiate between the various types of crises, the following chapter examines specific crisis typologies.

3.2 Overview of Typologies

Following the quote, “Dealing with crises means dealing with nightmares, and nightmares become less of a threat if someone turns on the light” (Gundel 2005, 106), understanding the different types of “crises” will be the initial step in effectively mitigating and controlling their associated risks. This will provide the theoretical foundation of CM for this thesis. According to Coombs (2012), each type of crisis necessitates a unique CM approach, and thus, conducting an independent analysis of each crisis type is essential.

Since there is no universally agreed-upon definition of a crisis (Coombs 2012), numerous scholars have tried to refine the ever-evolving concept of CM (cf. Björk 2016). Since crises are a social construction (cf. Quarantelli, Boin, and Lagadec 2018), the increasing momentum in these efforts stems from the recognition that the typologies that are effective today may not be as applicable in the future (cf. Thießen 2008). While different scientific disciplines employ various criteria to categorize crises, one commonality stands out. According to Thiessen (2008), there are two primary viewpoints when categorizing crises: the time and content perspectives. The time perspective regards a crisis as a multi-phase process, typically consisting of at least

three different phases, whereas the content perspective categorizes crises based on their inherent nature. According to Coombs (2012), these phases are usually termed pre-crisis, crisis, and post-crisis.

Considering the scope, complexity, and ambiguity of crises, researchers stress the importance of an interactive approach to understanding and managing crisis situations (cf. Björk 2016; Quarantelli 2018; Thießen 2011). In order to build a comprehensive picture CM will be examined from both a contextual and temporal perspective. Subsequently, several typologies in the content perspective that have developed solid guidelines and have demonstrated their effectiveness in risk and CM, along with crisis assessment, will be explored (cf. Björk 2016; Gundel 2005; Taleb 2007). Finally, integrating a time-based perspective into CM enables the identification of distinct triggers and characteristics associated with the different phases of a crisis (cf. Björk 2016).

The integration of these approaches forms the theoretical foundation of different crisis scenarios that will later be used in this thesis to apply and explore their implications (cf. Chapter 7).

3.2.1 Time Perspective: Operational Framework and Parameter

Starting with a focus on the pre-crisis phase is critical for maximizing the chances of preventing crises. However, this approach often faces significant criticism in public discourse, primarily because many crises could have been averted at this early stage (cf. Mitroff and Anagnos 2001; Thießen 2011). Mitroff and Anagnos (2001) state that all crises produce early signals. Once these signals surpass a certain "intensity threshold," they are escalated to a central unit within organizations for immediate action (ibid.). These signals can originate from technical elements or people and can be external (e.g., from communities or activist groups) or internal (from workers) (cf. Mitroff and Anagnos 2001). While Mitroff and Anagnos (2001) acknowledge that some crises may be more challenging to detect, executives are still expected to identify the early warning signals (cf. Carmeli and Schaubroeck 2008). However, detecting a crisis is not enough;

it is crucial to take preparatory actions and make organizational adjustments, such as enhancing structural system design or providing internal crisis scenarios (Pauchant and Mitroff 1992).

This highlights that pre-CM involves planning and detection in conjunction with an organization's comprehensive CM capabilities.

Following the pre-crisis and reaching the midpoint of a crisis in traditional CM is an unfavorable outcome because it signifies that the preventive measures have not succeeded in averting the crisis. Thankfully, with thorough preparation, organizations can utilize contingency plans as a response strategy (cf. Johansson and Pihl 2023). However, due to the vague and uncertain nature of many threats, adequate preparation and timely reaction are often insufficient (cf. Behnke and Eckhard 2022). In the acute phase of a crisis, effective communication, strategic decision-making, and performance management take on paramount significance (cf. Bundy et al. 2017; Linstone 1999; Thießen 2011). External crisis communication primarily aims to prevent catastrophic consequences for a company's reputation and, thus, to maintain financial stability. It involves adapting and strategically acting within a structured framework (cf. Thießen 2011). According to Linstone (1999), effective decision-making in crises requires a comprehensive understanding of complex problems by gathering information and identifying critical factors. It also involves the rigorous evaluation and suggestion of alternative solutions while ensuring that individual biases are set aside. Subsequently, selecting a choice that will be implemented is followed by a thorough evaluation of the process. These are vital steps in navigating decision-making in a volatile environment (cf. Boin and Sundelius 2016). However, particular emphasis must be given to the high uncertainty about the causes and crisis dynamics under which decisions are made.

Nonetheless, it is essential to recognize that while these responses are unquestionably vital for executive leadership, the operational responses to crises primarily stem from the mid-management level (cf. Bundy et al. 2017). This management level is tasked with translating

executive decisions into actionable measures at the operational level, thereby ensuring that the necessary steps are taken (ibid). The management directly interacts with employees, coordinates resources, and communicate information during a crisis. Their proximity to the operational level enables them to effectively manage and respond to crises (cf. Spagnoli et al. 2021). Emphasizing the significance of SI&C, a study by Reeves et al. (2022) underscores that performance during crisis periods exerts nearly three times the impact compared to performance during stable periods (Reeves et al. 2022).

While incorporating practices like performance reviews, which foster resilience, has been beneficial in managing crisis scenarios. (cf. “Global Survey: The State of AI in 2020” 2023), it remains true that effectively managing performance during these stages continues to be a challenging task requiring strategic adaptability and empathy, particularly in light of potential disruptions within established routines (cf. Ahlstrom et al. 2023).

In the post-crisis phase, the effects of the crisis – which can be both positive and negative – are analyzed in more detail and are further processed and adjusted (cf. Bundy et al. 2017). The aim is to emerge stronger from the crisis, restore social order, and learn from the aftermath (cf. Clair and Pearson 1998). This learning effect plays a central role in the final phase, as it can eliminate future problem areas and prevent long-term reputational damage. So-called OL or “the learning organization” plays an essential role in the post-crisis stage and is divided into single-loop (adaptation learning), double-loop (change learning), and deutero-learning (process learning), (cf. Bakacsi 2010). Ideally, the learning process should begin mid-stage, i.e., in the phase in which crisis communication arises. The more rapidly progress and deficits are recognized, the faster a crisis can be overcome, and improvements and restructuring can be initiated. Given the inherent ambiguity of crises, the post-crisis learning process is not standardized (cf. Lampel et al. 2009). Because companies tend to focus on specific details rather than learning broader principles, dealing with future crises can be problematic due to ignoring the significance of

taking action (cf. Chayanuvat and Yuan 2021). Consequently, it can lead to incorrect decisions and learning resistance, which implies a cognitively rigid approach to previous beliefs (cf. Lampel et al. 2009). Therefore, it is crucial to identify procedures for long-term problem management that can be implemented in the final phase (cf. Jaques 2009).

Although characteristic overlaps are not always apparent throughout a crisis period, specific characteristics can be applied to each time phase. These encompass detection and preparation during the pre-phase, decision-making, SI&C, and effective communication in the mid-crisis, and OL in the post-crisis phase. Despite some overlapping characteristics, this thesis, limited by scope, time, and capacity, will concentrate on analyzing the crisis phases and specific characteristics as detailed in Figure 1.



Figure 1: Overview of the relevant CM stage processes covered in this thesis (own representation)

3.2.2 Content Perspective: Operational Framework and Parameter

Crises are complex and occur across various fields, leading to numerous efforts to create frameworks for categorizing different types of crises. These frameworks usually try to pinpoint the typical domains and contexts in which crises occur (cf. Björk 2005; Gundel 2005).

The first attempts that were made in this regard distinguish different types of crises according to man-made (technological) and natural causation (i.e., Rosenthal and Kouzmin 1993), and to some extent, differentiate even further between man-made, natural, and social crises (cf. Quarantelli 2001). Further attempts have been made to differentiate between national or

international, corporate versus public, and ongoing or episodic crises (cf. Rosenthal and Kouzmin 1993; T'Hart Heyse and Boin 2001).

However, critics argue that it is increasingly challenging to separate multiple, often interconnected, geographically widespread causes of modern crises (cf. Rosenthal and Kouzmin 1993). For instance, despite being a natural catastrophe, global warming is not considered an “act of God” like a tsunami (cf. Gundel 2005).

Given that crises can have more than one origin, Rosenthal and Kouzmin proposed introducing several subcategories for crises, such as “oil spills” or “air disasters.” However, while a more detailed classification of crises may improve their differentiation, it also poses a challenge in identifying common characteristics (cf. Gundel 2005). This, in turn, hinders the clustering process, ultimately reducing the effectiveness of counteractions for handling these crises (cf. Gundel 2005; Thießen 2011). Gundel (2005) accordingly summarized that suitable typologies must follow four essential conditions: *1) They should define exclusive classes. 2) They should be exhaustive, even encompassing future events. 3) They should be practical, addressing prevention measures. 4) They should be pragmatic, ensuring manageability.*

The recent literature has shifted its focus to two-dimensional frameworks designed to meet these criteria (cf. Björck 2005; Gundel 2005). Table 1 presents three two-dimensional typologies frequently cited in literature (cf. Gundel 2005; Taleb 2004, 2007; Weiner 1995) and discusses a theory that has been further developed based on Weiner's Theory (cf. Coombs et al. 2012).

Table 1: Comparison of CM typologies (own representation based on Gundel 2005)

Source	Dimensions of Crisis Management	Position and discipline	Implications for Business Practice	Application in Crisis Phase
Gundel (2005)	Predictability and influence possibilities on the cause of crisis	Crisis and disaster management	Crisis management measures, regulation	Pre-crisis and Crisis Phase
Taleb (2004, 2007)	Probability of crisis occurring and impact	Mathematics risk and crisis management	Worst case scenario, resilience of organisations	Pre-crisis and Post-Crisis Phase

Weiner (1995)	Root causes of crisis (both internal and externally) and how to control/mitigate the cause	Sociology general audience and stakeholders	Responsibility by stakeholders attributed, emotions, behaviours, etc.	Pre-crisis and Crisis Phase
Coombs et al., (1995)	Root cause of crisis	Crisis communication for stakeholders	Stakeholders, emotions, behavioural factors, etc.	Pre-crisis and Crisis Phase

Following his defined conditions for an influential typology, Gundel introduces a typology of crises based on predictability (*i.e., how well the crisis can be known based on previous experiences*) and influenceability (*i.e., the ability to address the causes of a crisis*) resulting in a two-times-two matrix, whereby four types of crises can be distinguished. The first event describes a **conventional crisis**, such as poorly structured, well-known, predictable technological systems. Organizations can plan for these crises effectively, identifying disasters and testing countermeasures with clear risk and cost assessments (cf. Gundel 2005). In contrast to these, Gundel (2005) introduces **fundamental crises**, which strike at an organization's core, posing existential threats. These crises require comprehensive reassessment and fundamental restructuring of the organization. Gundel (2005) presents two additional categories that, while less severe, can still pose a threat if not adequately addressed. **Unexpected crises** possess some degree of predictability but remain concerning due to a lack of preparedness. On the other hand, **intractable crises** are challenging to address because although they can be anticipated to some extent, interference or resolution is almost impossible due to their complex and deeply rooted nature.

Another similar typology that has its roots in financial mathematics and statistics was developed by Taleb (2004, 2007). He proposed a new matrix with the dimensions 1) probability of occurrence and 2) payoff or impact (payoff is mainly used in financial modeling). Like Gundel's approach, Taleb divides the matrix into four distinct cases, the first of which represents a highly probable crisis with relatively low impact (is affordable), making it relatively easy to predict and manage (cf. Taleb 2007). This case closely aligns with Gundel's (2005) conventional crises (cf. Moradi and Levy 2020). In contrast, Case 2 portrays a highly

impactful scenario (not affordable) that necessitates the implementation of specific countermeasures, such as investments in safety measures and procedures (cf. Taleb 2007). Since this case can be foreseen through financial models, proactive measures should be taken to address the risk, as its occurrence is neither acceptable nor affordable (ibid.). The third case, has a relatively low impact (is affordable), and the likelihood of occurrence is difficult to predict. Still, given the low costs of such a scenario, the consequences are easy to remediate. An example of a remediation measure in this context could be the implementation of a Customer Bill of Rights, which provides compensation for delayed flights (cf. Taleb 2007). An example of a remediation measure in this context could be the implementation of a Customer Bill of Rights, which provides compensation for delayed flights (ibid.). The last scenario that is most frequently discussed is the black swan in the so-called “Fourth Quadrant,” which describes a highly improbable and unpredictable event that is characterized by three different principles:

1) illusion of understanding, 2) retrospective clarity of history, and 3) overvaluation of information and blind trust (ibid.). In other words, people tend to find explanations that make the origin of an event appear less random and more predictable than it was; the collapse of the Soviet Union or the 9/11 terrorist attacks are examples of such events that, at the time of their occurrence, lay beyond the realm of average expectation (cf. Taleb 2004).

Taking a different approach, Weiner (1985) introduced the attribution theory, initially rooted in sociology and psychology, which was later adapted for crisis communication by Coombs (2012). Weiner’s (1985) theory posits that people’s perception of an event is significantly influenced by information provided by media, organizational responses, experts, and other sources, along with attributed responsibility. To categorize events, Weiner (1995) employs the dimensions of the locus of causality (whether the cause is internal or external to the organization) and controllability (whether the cause was within the organization’s control). In line with this theory, stakeholders tend to exhibit a more positive and sympathetic attitude when

a crisis is attributed to external causes. In contrast, crises rooted in internal factors often lead to the perception that the organization is at fault (cf. Weiner, 1985).

Drawing from Weiner's attribution theory, Coombs (1995, 2002, 2007) adapted the framework to crisis communication needs and created the situational crisis communication theory. This is a widely recognized framework for categorizing crises that sorts them into distinct clusters based on how stakeholders attribute responsibility during a crisis (cf. Coombs 2012). These clusters include intentional, preventable, and inevitable crises. Intentional crises are associated with the highest level of responsibility and encompass crises that are deliberately caused and are preventable. In contrast, inevitable crises entail the lowest level of responsibility as they arise from external factors beyond the organization's control (cf. Coombs 2007).

Considering the complexity of crises, various typologies can be applied to defining CM implications. However, it is essential to note that Coombs and Weiner's models, while not initially rooted in CM in general, are more suited to crisis communication and behavioral theory, which, given the previously defined time dimensions and their characteristics as relevant to this thesis (cf. Chapter 3.2.1), will not serve as the primary reference points for distinguishing various CM scenarios although they might prove valuable in future research with a broader scope.

In the case of Gundel and Taleb, both frameworks are incorporated into this thesis, as pre-crisis, (mid-) crisis and post-crisis scenarios will be analyzed and hence need appropriate representation in the utilized content typologies, which cannot be assured by using only one typology (cf. Table 1). Nonetheless, since both Gundel's defined **conventional crises** (easily predictable and easily influenceable) and Taleb's (2007) first case scenario (highly probable, but very affordable) exhibit significant similarities in both frameworks, **a conventional crisis can be summarized as follows:**

Based on Gundel's and Taleb's approaches, a conventional crisis consists of an event that is either easily predictable or whose occurrence is known (mediocrity) and is easily influenceable in terms of costs and complexity.

However, in **extreme scenarios** that cannot be summarized under a conventional crisis, applications might be tested or chosen based on the analyzed time perspective (cf. Table 1). For this thesis, they **can be denoted as follows**:

Extreme scenarios arise when 1) either the predictability or occurrence of an event is unknown, 2) when affordability is not given (impact is high) or influenceability is nearly impossible, or 3) if both conditions 1) and 2) are met.

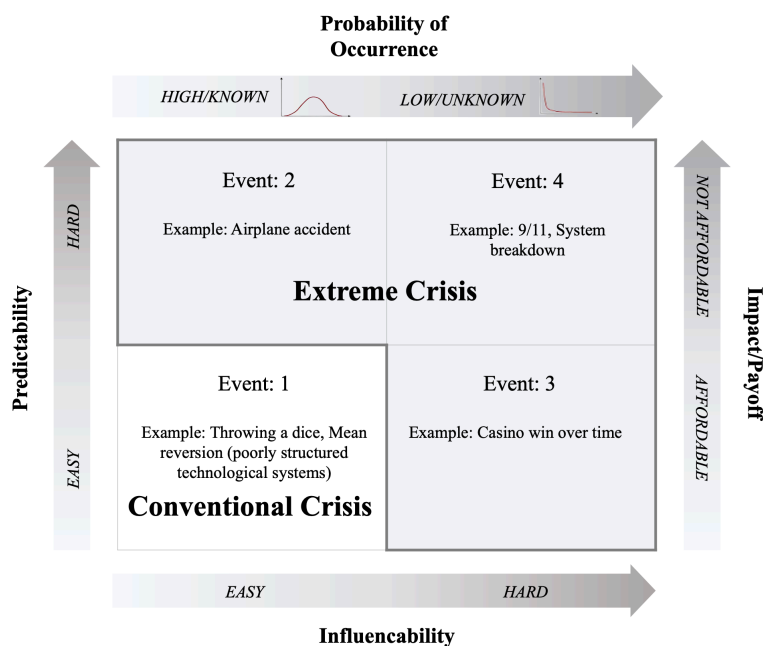


Figure 2: Content dimensions (own representation based on Gundel 2005; Taleb 2004, 2007)

To conclude, each type of crisis demands a unique approach – ranging from a swift response to comprehensive transformation – depending on its characteristics and underlying factors.

4 Artificial Intelligence

4.1 Definition

The inception of the term “AI” can be traced back to 1950, when Alan Turing posed a seminal inquiry in his work “Can Machines Think?” (cf. Turing et al. 2022). Turing extensively explored this inquiry using the Imitation Game, a method designed to investigate the capacity of machines to handle cognitive processes. Over time, AI’s definition, research focus, and application scope have transformed significantly from theoretical to tangible applications, resulting in many different definitions (cf. Helm et al. 2020). These definitions have progressively evolved, incorporating new dimensions of research, such as big data or machine learning (ML). To establish the research focus of this work, the emphasis lay on identifying commonalities across diverse areas.

Table 2: Comparison of AI definitions (own representation)

Year	Definition	Author
1950	“AI is the science and engineering of making intelligent machines, especially intelligent computer programs.”	Alan Turing
1955	“The science and engineering of making intelligent machines getting a computer to do things which, when done by people, are said to involve intelligence.”	John McCarthy
2013	“Make decisions which normally require [a] human level of expertise and help people anticipate problems or deal with issues as they come up.”	Shubhendu and Vijay
2017	“Artificial intelligence is a computer system capable of performing tasks that normally require human intelligence... a lot of these AI systems rely on Machine Learning, some on Deep Learning, and some on very boring things like rules.”	Jeremy Achin
2018	“Artificial intelligence (AI) is a wide-ranging tool that enables people to rethink how we integrate information, analyze data, and use the resulting insights to improve decision making—and already it is transforming every walk of life.”	Darell M. West and John R. Allen

Given the commonalities among the definitions, the predominant AI characterization for this work can be described as *an interdisciplinary field creating intelligent machines for tasks requiring human-like intelligence and thereby transforming information integration and decision-making processes.*

AI systems integrate “a set of technical and software tools combined by the information process, capable of synthesizing a goal based on information and knowledge, making rational decisions,

and finding rational ways to achieve the goal and decisions made, whether in interaction with a person or independently” (cf. Raximov et al. 2021, 1-3).

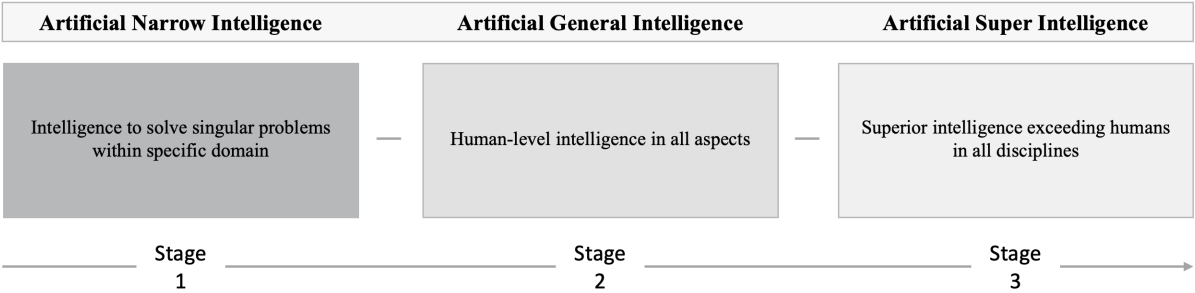


Figure 3: Comparison of AI typologies (Turchin et al. 2017)

Moreover, AI can be broken down into three main stages. The initial category, *Artificial Narrow Intelligence* (ANI), encompasses systems adept at executing predetermined tasks but lacking the capacity for autonomous learning or adapting beyond their programmed functionalities (cf. Kuusi and Heinonen 2022). An illustrative example is the Apple voice assistant Siri, which is proficient in handling specific queries but unable to handle unprogrammed questions. This limitation places ANI below the threshold of human intelligence, a distinction that is rooted in humans’ inherent capacity for continuous learning and adaptation.

The subsequent stage, *Artificial General Intelligence* (AGI), seeks to comprehensively replicate human intelligence. AGI envisions AI systems capable of continuous learning, adept problem-solving, proactive future planning, and seamless adaptation to unforeseen scenarios. AI solutions exhibit autonomous cognitive abilities at this stage, enabling independent decision-making without human intervention (cf. Goertzel and Pennachin 2019). Despite significant progress in ANI, AGI remains an unexplored frontier, representing the cutting edge of AI research and innovation.

Finally, the third stage can be defined as *Artificial Super Intelligence* (ASI). This hypothetical scenario envisions AI machines not merely replicating human tasks with equal proficiency but surpassing human capabilities. This unexplored realm surpasses the scope of current discussions and consequently lacks extensive research. However, delving into this territory

raises significant concerns about relinquishing control from human oversight, necessitating careful consideration (cf. Gill 2016).

4.2 Branches

When comparing AI and human capabilities, it is important to not overlook the technological branches that enable AI applications.

AI: Artificial Intelligence; **ML:** Machine Learning; **NN:** Neural Networks; **DL:** Deep Learning

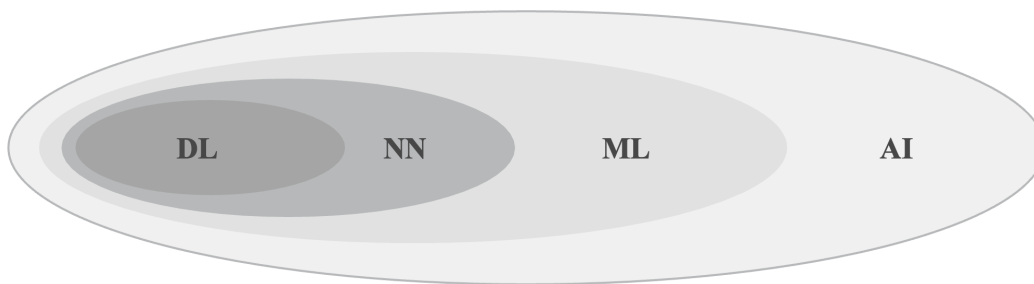


Figure 4: Branch model of AI (Janiesch, Zschech and Heinrich 2021)

Due to scope limitations, this study will solely focus on four pivotal branches of AI that are practically relevant to the research questions.

ML, a branch of AI, “is the scientific study of algorithms and statistical models that computer systems use to perform a specific task without being explicitly programmed” (Mahesh 2020). ML requires large amounts of high-quality historical data that is collected, processed, and extracted to provide the basis from which to learn (cf. Domingos 2012). The programs undergo several iterative training sessions to react to specific situations and make informed decisions precisely (cf. Mahesh 2020). When learning from data, ML programs can discover hidden patterns and automatically make accurate predictions on new data without relying on a human programmer (ibid.). However, over time, scientists moved away from code-based ML and thus created neural networks (NN) (cf. Chen et al. 2017, 7-9).

NNs are pivotal in ML, acting as a cornerstone by replicating human intelligence. They excel in modeling complex input-output relationships, discerning data patterns, and extracting statistical structures from observed data (cf. Baesens et al. 2003). Their adaptability to intricate

and non-linear relationships between inputs and outputs makes them well-suited to address intricate real-world issues (cf. Chen et al. 2017, 7-9).

Furthermore, introducing NNs has enabled deep learning (DL) processes, which are sophisticated and mathematically complex evolutions of ML algorithms (cf. Samek et al. 2021). While ML follows a relatively linear regression, DL comprises multi-layer NN, which enables even less human interaction and faster and better outcomes (ibid.). However, it also requires more extensive and qualitative datasets to deliver these benefits (cf. Nife and Chtourou 2023). DL models are the foundation for contemporary and potent Large Language Models (LLM) exemplified by GPT, BERT, GPT-4, and the more recent Gemini (cf. Dong et al. 2023). These models leverage Natural Language Processing (NLP) techniques, thereby enabling computers to analyze, comprehend, and respond to our natural modes of communication, including speech and written text. Generative AI (GenAI) belongs to the subset of LLM utilizing ML to understand provided inputs and generate novel content (cf. Sun et al. 2022).

The synergy between LLM and NLP can enhance various NLP tasks, spanning natural language translation, information retrieval, information mining, text summarization, question answering, topic modeling, and, most recently, opinion mining (cf. Chowdhary 2020, 606f).

In summary, the combination of LLM and NLP is pivotal for achieving GAI's status. This significance arises from advanced language comprehension and generation, proficient learning capabilities, and the potential for transfer learning. Collectively, these components contribute to developing more intelligent and adaptable AI systems (cf. Kanbach et al. 2023; Wang 2023). In addition to classifying AI according to typologies, it is also segmented based on the degree of autonomy intended for humans. The delineation involves five levels to specify how AI can function independently within a specific domain (cf. Li and Hilliges 2021; Prunckun 2018).

In the “**No Autonomy**” phase, humans retain exclusive authority, and the AI strictly functions as a tool under their direct control without any automated support (ibid.).

Advancing to “**Low Autonomy (Assistance)**,” the AI assumes a supportive role, offering information, suggesting options, or assisting. Nevertheless, humans’ ultimate authority remains vested, aligning with the “Human in the Loop” model (ibid.).

Upon entering the “**Moderate Autonomy**” phase, the AI gains the ability to execute some processes and decisions independently. Despite this autonomy, humans retain control and can intervene as necessary, following the “Human on the Loop” model (ibid.).

Progressing to “**High Autonomy (Partial Automation)**,” the AI decides and executes most questions and challenges. However, humans retain the capacity to intervene in specific situations or manage exceptions, akin to the “Human in the Loop for Exceptions” model (ibid.).

At the peak, in “**Full Autonomy (Full Automation)**,” the AI makes all decisions independently, and human intervention is confined to specific predefined requirements. This corresponds to the “Human Out of the Loop” model, in which AI operates independently, and human involvement only occurs in predefined circumstances (ibid.).

4.3 Benefits and Risks

The future impact of AI, driven by the rapid pace of technological change, remains a subject of debate and discussion, punctuated by the juxtaposition of benefits and risks that this transformative force presents.

One primary advantage, and indeed a significant one, is the economic benefit AI affords. A McKinsey study highlights that AGI alone can potentially unleash economic benefits ranging from \$2.6 trillion to \$4.4 trillion if broadly applied across industries. Moreover, non-GenAI and analytics could unlock an estimated \$11 trillion to \$17.7 trillion (cf. Chui et al. 2023). Concrete evidence indicates that companies actively embracing AI in their quarterly results have seen stock value growth of up to 40% in 2022 (cf. Vohra et al. 2023), with AI contributing to at least 20% of EBIT in that year (cf. Hall et al. 2023).

Productivity gains are a driving force behind this economic surge, whereby automation, increased accuracy, speed, and real-time optimization play pivotal roles. AI's capacity to automate repetitive, labor-intensive tasks efficiently while significantly reducing the margin for human error through robust, extensive data analysis underscores the efficiency enhancements it brings (cf. "Emerging AI Risks Underscore Urgent Need for Responsible AI" 2023; Araujo et al. 2020).

Beyond productivity, AI catalyzes novel business models. It fosters innovative ideas and content, from video advertisements to research and development (cf. Garbuio and Lin 2021; Lee et al. 2021). Moreover, AI tailors customer experiences, allowing for highly personalized interactions and targeted advertisements based on unique behavioral patterns.

Even more relevant, AI's transformative potential extends to addressing some of the world's most pressing issues, i.e., those mentioned in Chapter 1. AI's predictive capabilities can enhance disaster forecasting, while its medical diagnostic applications have the potential to revolutionize healthcare (cf. Abid et al. 2021; Mosavi et al. 2018).

However, the progressive integration of AI also harbors significant risks and challenges. Among these are the potential crises induced by AI, encompassing issues such as mass unemployment, power concentration, bias, ethical concerns, and AI safety (cf. Marr 2023). An EU-wide study found that 14% of jobs in OECD countries are highly automatable, with an additional 32% susceptible to substantial transformation (cf. Scarpetta and Pearson 2022, 1-3). This scenario underscores the need to upskill millions of low-skilled workers and to retrain high-skilled workers to maintain competitiveness in the job market. The implementation of AGI exacerbates this displacement of jobs, compelling governments to formulate action plans (cf. Kornai 2014). In particular, AI is expected to impact repetitive tasks significantly (Metz, 2023). On the one hand, automation through AI can create free capacity for the people responsible (ibid.). On the other hand, it threatens job opportunities for those who specialize in repetitive

tasks (ibid.). Companies such as Klarna, the Swedish payment provider, announced a hiring stop for all departments except for its engineering department, as AI can already take over most tasks within the company (cf. Nolan, 2023).

Concurrently, the intensifying war for talent is evident, with 41% of organizations experiencing a shortage of data science skills (cf. “Winning the War for Talent” 2023). In comparison, 55% require more individuals with AI skills but face challenges in sourcing them, resulting in suppressed wages and heightened inequality due to labor market polarization (cf. “Winning the War for Talent” 2023; Moradi 2020).

The risk of AI development being monopolized by a handful of mega-corporations and governments is significant, exacerbating inequality and stifling diversity in AI applications. Recent findings from the EU underscore the predominance of just two countries, namely the US and China, in the AI landscape, signaling a potential escalation of their competitive advantage (cf. “AI Watch Index” 2022).

Furthermore, a narrowed focus on a limited number of providers may heighten the risk of a financial crisis (cf. Liu et al. 2022). This is particularly evident when reliance centers on a standard underlying base model or data aggregator, particularly if this reliance is placed on significant technology companies rather than the brokerage side. Such a scenario could give rise to a herd mentality, in which various parties make decisions based on the same data model, thereby compromising stability (cf. Maslej et al. 2023). Biased data further exacerbates this risk, potentially resulting in subpar or hazardous recommendations. Additionally, it could contribute to an undesirable increase in uniformity, interconnectedness, and the exploitation of regulatory loopholes (cf. Brodsky 2023; Gensler and Bailey 2020).

The specter of bias in AI is ever-present, as the opaqueness surrounding decision-making processes and algorithmic logic can perpetuate societal biases rooted in skewed training data or algorithm design. For instance, an AI recruitment system trained on data from male-dominated

management companies might erroneously conclude that female candidates are unfit for top-level roles (cf. Gryn and Rzeszucinski 2018).

Furthermore, the proliferation of third-party AI tools introduces diverse risks, including reputational harm, loss of trust, financial losses, legal repercussions, compliance challenges, and litigation (cf. “Generative AI” 2023).

In this context, the ethical and security concerns span are also divers, encompassing the misuse of AI for nefarious activities such as cyberattacks, and the existential risks associated with ASI surpassing human cognitive capabilities (cf. Borstrom 2014, 60). Cyberattacks encompass a spectrum of threats, including next-generation malware, voice synthesis, password-based attacks, social bots, and adversarial training (cf. Kaloudi and Li 2012). The ethical dimension of these concerns is underscored by the perpetual evolution and self-learning capabilities intrinsic to these technologies (cf. Maslej, et al. 2023). Their autonomous learning mechanisms exacerbate the challenge of managing ASI, necessitating regulatory interventions to exert control (cf. Alfonseca et al. 2021). As a result, the potential consequences of biases, misuse, and the curtailment of human agency within software applications are profound and hence the domains of science and politics are currently directing heightened attention toward regulatory frameworks and ethical considerations in this evolving landscape (cf. Maslej et al. 2023).

These multifaceted facets of AI compel organizations and policymakers to navigate the AI landscape with prudence and foresight. It is recommended that a examination of the risks and benefits be performed for each specific use case to analyze its true potential.

4.4 Limitations, Restraints and Regulations

In the realm of AI, the existing literature underscores many challenges and limitations that can broadly be categorized into three significant domains: technical, financial, and ethical constraints.

In AI, several technical challenges impede its seamless integration and effectiveness. Firstly, the reliance on data quality and availability is paramount, as AI models heavily depend on the characteristics of their training data to recognize patterns. The decisions made by these systems are inherently tied to their training data, thereby introducing the potential for errors or inaccuracies when confronted with novel or unforeseen scenarios (cf. Frackiewicz 2023; Nandana 2023). Another critical concern is the presence of data bias, both algorithmic and within the training data itself. AI algorithms are susceptible to systemic inaccuracies due to algorithmic bias, and insufficiently large or representative datasets hinder the system's learning process (cf. Frackiewicz 2023; Marsoof et al. 2022).

Transparency and reasoning further compound the challenges, as the decision-making processes of AI can be opaque, making it challenging to comprehend the rationale behind specific outcomes (cf. Daneshjou 2023). Additionally, the fundamental reliance on data models poses a unique set of challenges in various contexts where transforming data into mathematical problems may be more complex (cf. Marsoof et al. 2022). The lack of robustness in AI systems adds another layer of complexity, as their intricate nature and reliance on extensive data and algorithms make them challenging to interpret (ibid.). Furthermore, their vulnerability to manipulation by malicious actors and inability to explain conclusions that are drawn raises serious concerns (cf. Adcock 2023).

On the financial front, the resource-intensive nature of AI poses barriers to adoption, particularly for small and medium-sized enterprises. The substantial computing power and specialized hardware required for AI implementation can render it inaccessible, contributing to a notable 28 percent failure rate of AI initiatives and raising environmental impact concerns (cf. Fardian 2023).

Ethically, AI forces users to grapple with hard choices when confronted with morally equivalent alternatives, especially since relying on utility models and reward functions creates limitations

in evaluating nuanced decisions (cf. Marsoof et al. 2022). Furthermore, the lack of emotional intelligence and contextual understanding presents challenges in applications requiring a profound grasp of human behavior, such as mental health diagnosis or customer service. AI systems struggle to comprehend human emotions, cultural nuances, and social cues, highlighting the need for further development in these areas (cf. Adcock 2023).

These technical, financial, and ethical challenges underscore the multifaceted obstacles that must be addressed for AI's responsible and effective integration into various domains.

Incorporating these intricate challenges is paramount for organizations and policymakers as they chart the course for AI implementation while considering the far-reaching ramifications of this paradigm-shifting technology (ibid).

Given these technical and ethical constraints and the growing prominence of AI, developed nations are proactively enacting localized legislation to navigate the landscape of this transformative technology. However, a unified global approach is conspicuously absent in this context. Nevertheless, it is noteworthy that in November 2023, the UN took a significant step by establishing an advisory body to foster a globally inclusive approach to the governance of AI (cf. NIST 2023; Kohn and Pieper 2023; European Parliament 2023).

The implementation methods span a spectrum ranging from voluntary guidelines and recommendations, as observed in the US, to the enactment of draft laws, exemplified in China and the EU (cf. Fischer et al. 2023). Broadly, most countries concur that AI should be subject to limitations, with uniform standards akin to those applied to analogous technologies. These standards encompass concerns related to cybersecurity, privacy, safety, and infrastructure (cf. NIST 2023). The overarching goal is to safeguard individual liberties and rights while fostering safety and innovation (cf. Manoj and Sahil, 2023).

In this context, various supranational organizations and consultancies frequently invoke the concept of responsible AI. Responsible AI is defined as designing, developing, and deploying

AI with benevolent intentions to empower employees and businesses and positively impact customers and society, thus enabling companies to cultivate trust and confidently scale AI (cf. Eitel-Porter et al. 2023).

Responsible AI should encompass the following critical dimensions: data and system operations, explainability, accountability, consumer protection, lack of bias and fairness, and robustness (cf. RAI 2023). While criticisms have been voiced regarding potential innovation constraints, the collective emphasis remains on maximizing societal benefits (cf. Castro 2023).

5 Research Status and Gap

While AI has seamlessly integrated into many people's private lives through virtual assistants such as Cortana, Alexa, and Siri, its practical application within organizational CM has largely remained unexplored (cf. Taurins 2023; Tzachor et al. 2020).

However, recent research suggests that harnessing the power of big data analytics, ML, and DL to derive data-driven metrics and measurement applications can prove instrumental in (re)building a company's resilience, averting further disasters, and monitoring flexibility (cf. Bharadiya 2023; Bocchini et al. 2020; Kantaş 2023). This underscores the growing significance of capitalizing on AI's technological advancements to establish metrics rooted in data and to bolster preparedness for future crises. Farrokhi et al. (2020) suggest that utilizing ML to extract information from everyday data exchanges, such as emails, can improve the early detection of critical events associated with business operations. Moreover, researchers such as Essien and Petrounias (2022, 10) have proposed that exploring the potential of collaborative AI processes in decision-making could yield beneficial outcomes in diverse contexts. Similarly, potential applications of NLP, for example, are also evident in OL for training and development (cf. Carrera-Ruvalcaba et al. 2019; Domala et al. 2020), as well as in SI&C, particularly in communication and task automation (cf. Naidoo and Dulek 2022).

Nonetheless, despite recognizing the potential of AI in certain areas, such as decision-making (cf. Essien and Petrounias 2022) and identification of possible AI applications for early detection, such as enhancing auto-detection algorithms through AI integration (cf. Kemper and Kemper 2020, 1677), significant gaps remain in the current research.

Firstly, the adaptability of AI to various crisis scenarios remains an under-explored dimension. Given the varying levels of crisis severity, spanning from conventional to extreme scenarios, the applicability of AI within different crises often needs to be addressed (cf. Chapter 3.2).

Secondly, there needs to be a more critical assessment regarding the extent of human involvement needed and the level of autonomy with which the AI performs its function.

Lastly, while most papers provide theoretical insights into AI integration, they tend to fall short in offering concrete examples of integration. Specifically, integrating AI into existing tools, strategies, and techniques used in ED&P, decision-making, SI&C, and OL is seldom elaborated upon. This gap between the theoretical potential and practical application makes it challenging for organizations to effectively incorporate AI into their CM practices without further research and guidance (cf. Forbes 2023).

Based on the overarching research question: “Can the integration of AI in CM contribute to improving a company’s response to future crises and, in turn, fortify its resilience?” and considering the thesis defined scope and the highlighted significance of the study, the following research questions and hypotheses were derived:

RQ1: What constraints or boundaries are faced within CM of AI, particularly regarding the level of human involvement needed and its applicability in different crisis scenarios, such as during extreme situations?

H1: The effectiveness of AI in CM is limited, especially in extreme scenarios. Furthermore, AI applications exhibit varying degrees of autonomy, indicating differences in overall AI autonomy levels.

RQ2: What are the upcoming applications and potentials of AI within the various phases of a crisis, and how might the practical integration of these AI applications be manifested?

H2: The integration of AI into CM is anticipated to yield diverse applications and potentials across various phases, influencing detection and prevention, decision-making, SI&C, and OL.

H3: AI applications can be effectively implemented at an operational level.

These hypotheses will be further analyzed within the areas of ED&P, decision-making, SI&C, and OL.

6 Methodology

6.1 Systematic Literature Review

A systematic approach was adopted to ensure transparency and comprehensiveness in the literature research for the analysis, following the methodology presented in David Tranfield's article "Towards a Methodology for Developing Evidence-Informed Management Knowledge through Systematic Review" (2003). The starting point for the literature research was the Google Scholar database, and a citation search was conducted encompassing both backward and forward searches, as outlined by Hirt and Nordhausen (2019). The backward search involves the identification of older publications through examination of the search hits' bibliographies (ibid). In contrast, the forward search identifies more recent publications that cite these search hits (ibid.). Additionally, sources that may not be directly related to the topic itself but meet the criteria for applications within the domains of this thesis are also utilized for the analysis.

Moreover, it is crucial to note that, as identified in the research gap, finding recently published papers that specifically address limitations and tools can be quite challenging. To compensate for this, in addition to the Systematic Literature Review, a broader range of information sources beyond Google Scholar and academic search engines are being employed. This includes website articles, such as blog posts, expert contributions on LinkedIn, and content from

potential service providers' websites, in order to access more up-to-date insights. This approach utilizes a straightforward keyword search method (cf. University of London 2023). It is worth noting that the listed search results from the "Google Scholar" database and the simple keyword search using the "Google Search Engine" are limited from November 1, 2023, to December 5, 2023. Overall, 47 articles and online sources have been used for the analysis of potentials within the phases of ED&P, decision-making, SI&C, and OL (cf. Appendix 1).

6.2 Qualitative Interviews

To comprehensively address the research questions, a qualitative approach was chosen to fill the identified research gap outlined in Chapter 4.2. This approach is grounded in appreciating purposeful action and the nuanced interpretation of interview information (cf. Buber and Holzmüller 2009, 444). Despite the limited number of participants, this non-standardized, multi-stage survey endeavored to derive generalizations within the framework of an in-depth analysis (cf. Helfferich 2011, 26). Given the inherent lack of representativeness, such generalizations are rooted in theoretical derivations (cf. Mey and Mruck 2011, 264).

Throughout the various phases of the research process, decisions were made concerning the interview format, participant selection, and data analysis. A guideline-based expert interview format was adopted to facilitate a structured interview process while maintaining compatibility (cf. Bortz and Döring 2006, 314-318).

In the initial phase, interview guidelines were developed based on the central research questions and validated through multiple pre-tests (cf. Appendix 2). Concurrently, potential experts were meticulously selected and approached, whereby in this context expert status was not treated as a predetermined characteristic but attributed by the interviewer based on the specific research interests (cf. Meuser and Nagel 1991, 443-445). The selection criteria for knowledge carriers emphasized pronounced expertise in reflexivity, coherence, certainty, and practical effectiveness to derive actionable recommendations (cf. Bogner et al. 2014, 14).

Out of 115 potential experts contacted from academia, consulting, industry, and government, 16 agreed to participate in the interviews (cf. Appendix 3.1). This cohort comprised six individuals from industry, four from academia, four from consulting, and two from governmental organizations, all with a distinct focus on crises. A deliberate effort was made to ensure relevant heterogeneity, diversifying backgrounds by age, gender, organizational size, and industry sector (cf. Buber and Holzmüller 2009, 444). The interviews were conducted during standard business hours, from 9 a.m. to 8 p.m., from October to November 2023. Each interview was allocated 45 minutes, although the actual duration varied between 26 and 55 minutes due to unforeseen scheduling conflicts and comprehensive pre- and post-interview discussions, whereby an average interview duration of 38 minutes was recorded. The choice of an online setting posed no hindrance, given the fulfillment of the requirement for a quiet environment. This ambiance is pivotal for the interviewees' concentration and ensuring optimal acoustics and the consequent quality for the audio recordings (cf. Helfferich 2011, 177). The approach used was designed to provide a comprehensive perspective on the impact of AI in CM and validate the data through diverse professional lenses.

6.3 Quantitative Content Analysis

The data analysis phase constituted a significant portion of the research timeline, given the requirement of transcribing the information gathered from the interviews for the subsequent evaluation (cf. Buber and Holzmüller 2009, 657). Employing a qualitative category-based text analysis, facts and procedures were extracted from the interviews to derive insights into the potential, limitations, and requirements for applying AI in CM (cf. Mayring and Frenzl 2014). After partially transcribing the interview outcomes, the anonymized audio recordings and written transcripts were coded and evaluated in an Excel spreadsheet (cf. Appendix 3). The results were recorded and assigned to thematically appropriate headings (cf. Appendix 3; Gläser and Laudes 2006, 46). Subsequently, a comprehensive review was conducted to identify core

statements, focal points, and theses. A preliminary assessment of the statements was undertaken throughout this review process, focusing on objectivity, reliability, and validity criteria. This analysis aimed to yield pertinent recommendations for application areas, limitations, and requirements within each CM phase.

7 Impact of Artificial Intelligence in Each Crisis Management Process Stage

The subsequent chapters aim to delineate and aggregate the applications of the use of AI in CM across the pre-, mid-, and post-CM phases, encompassing ED&P, decision-making, SI&C, and OL. This exploration is built upon a systematic literature review, cross-references, and insights from qualitative interview analyses.

While the structure of the sub-topics may vary or be tailored to the specific chapters, the overarching format revolves around:

In-depth exploration: Offering a comprehensive overview of each topic relevant to the category.

This includes a discussion of critical characteristics for the success or failure of each phase.

AI applications identification: Delving into potential applications of AI, informed by findings from a systematic literature review and insights garnered from the interviews complemented by practical examples of operational integration (if possible).

Discussion of the findings: In particular, regarding the involvement of AI, the human role, and applicability towards extreme scenarios.

*It should be noted that the Experts (E) mentioned in the following chapters refer to the experts interviewed for the purpose of this thesis (see Transcripts in Appendix 5).

7.1 ///

7.2 Decision Making – by Sinah Janssen

This chapter proceeds on the premise that the relevant department and managers have effectively recognized a crisis during its early stages. Despite this early recognition, they could

only partially avert or mitigate the crisis using existing contingency plans, thereby necessitating further decision-making.

7.2.1 Description

The integration of AI into decision-making processes is attracting significant interest and provoking discussions across numerous industries. Notably, in the realms of automotive and aviation, the conversation tends to revolve around the deployment of AI in enhancing control systems, ensuring safety, and improving navigation capabilities, with a strong emphasis on its potential to increase both efficiency and reliability (cf. Gülen 2022; Ziakkas, Plioutsias, and Pechlivanis 2022). Yet, the strategic implications of AI in decision-making, especially in managing organizational crises, warrant deeper examination. In these critical contexts, AI's influence extends beyond everyday operational decisions, potentially altering the strategic course and resilience of an entire organization (cf. Burnett 1998, 476-480).

Transitioning to the domain of crisis response, decision-making exhibits distinctive characteristics. Emergency situations demand a decision-making approach that is both dynamic and decisive (cf. Burnett 1998, 476-480; Chermack 2004, 296). Time pressure, control dilemmas, and increased levels of threat become central concerns (ibid.). Decisions must be made within evolving contexts that often restrict available options (ibid.). Brehmer (1992, 211-212) further elaborates that in crisis decision-making, choices are interdependent, as current decisions significantly impact future ones. The environment itself is a dynamic player, evolving in reaction to decisions made, thereby adding to the complexity (ibid.). The essence of crisis decision-making lies in the immediacy of action, as decisions must be taken promptly to effectively navigate the challenges presented (ibid.). Additionally, in such high-stress scenarios, the burden of decision-making tends to fall on a select group of individuals bearing the critical responsibility of steering the organization through the crisis (cf. 'T Hart, Rosenthal, and Kouzmin 1993, 14).

To gain profound insights into how AI systems can effectively complement and enhance these decision-making complexities in crises, a comprehensive understanding of the cognitive challenges and requirements that arise during different phases and situations of crisis decision-making must be derived. This involves examining the overarching framework of decision-making, exploring the fundamental cognitive concepts that underlie sense-making, and gaining an understanding of the skills, tools, and techniques employed in the decision-making process.

Decision-Making Process and Cognitive Concepts

Decision-making in crises is a dynamic and complex process, involving several critical stages of sense-making (cf. Hale, Hale, and Dulek 2006, 302-304; Goh 2021; Raguz 2007, 1). The process initiates with the collection and analysis of information to thoroughly understand the crisis, a phase fundamental to shaping subsequent actions (ibid.). Following this, decision-makers explore potential solutions, brainstorm strategies, and evaluate various alternative responses based on effectiveness, resource requirements, and risks (ibid.). The culmination of this process involves selecting the most appropriate alternative based on the evaluations gathered (ibid.).

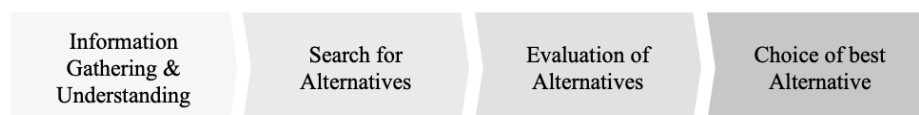


Figure 5: Decision-making process (own representation)

These stages of decision-making (cf. Figure 9), although theoretically sequential, often overlap and intertwine in practice and require adaptability and flexibility from decision-makers (cf. Goh 2021). Furthermore, the process typically involves aspects of implementation within decision-making (cf. Harrison 1996, 48-50), which will be explored in greater detail in Chapter **Fehler!**
Verweisquelle konnte nicht gefunden werden..

Moreover, while the provided framework offers a basic structure for decision-making, the depth of sense-making that guides the phases and affects the resulting decisions is heavily dependent

on the unique situations and experiences encountered by decision-makers (cf. Behnke and Eckhard 2022, 4; Buzna et al. 2007, 3; 'T Hart, Rosenthal and Kouzmin 1993, 239).

During crises, decision-makers typically rely on two primary approaches for sense-making: intuitive and rational decision-making (cf. Sayegh, Anthony, and Perrewé in 2004, 181). On the one hand, intuitive decisions are typically made in response to high-pressure situations, where individuals rely on their intuitive behaviors, drawing upon cognitive models such as mental heuristics, schemas, or metaphors as the foundation for processing information and data (cf. Sayegh, Anthony, and Perrewé in 2004, 184-187). These cognitive models encompass biases, values, emotions, and beliefs that have been shaped by individuals' experiences (cf. Sayegh, Anthony, and Perrewé 2004, 184-187; Senge 2006, 71-141). They wield significant influence over how people perceive the world, frequently guiding them toward outcomes that align with their expectations (ibid.). Importantly, individuals are frequently unaware of how these mental models impact their behavior (ibid.).

On the other hand, while the rational approach assumes that conducting exhaustive searches and maintaining objectivity in assessing alternatives are attainable goals, it often overlooks potential biases and constraints (cf. Heracleous 1994, 16-19). In highly dynamic, uncertain, and information-scarce environments, especially in extreme situations, depending exclusively on rational decision-making may not be practical or feasible (cf. Boin et al. 2016, 34-38; Sayegh, Anthony, and Perrewé 2004, 81-190). Conversely, low-pressure situations tend to favor more structured and rational responses.

Although rational and intuitive decision-making approaches have often been viewed separately in literature, there is a common acceptance that strategic decision-making, as applied in crises, might require a combination of both approaches (cf. Elbanna and Child, 2007; Hodgkinson and Clarke 2007). Mufti (2013), for instance, argues that while managers' intuition can be valuable, it should be complemented with analytical approaches to ensure a thorough exploration and

evaluation of alternatives. Furthermore, Sayegh, Anthony, and Perrewé (2004) emphasize the importance of rationality, particularly in the context of processing information in the beginning of the decision-making process, to facilitate a more accurate perception and interpretation of the event.

Synthesizing the various findings and integrating them with the CM definitions outlined in Chapter 3.2.2.2, the subsequent figure has been developed to support further analysis in this thesis:

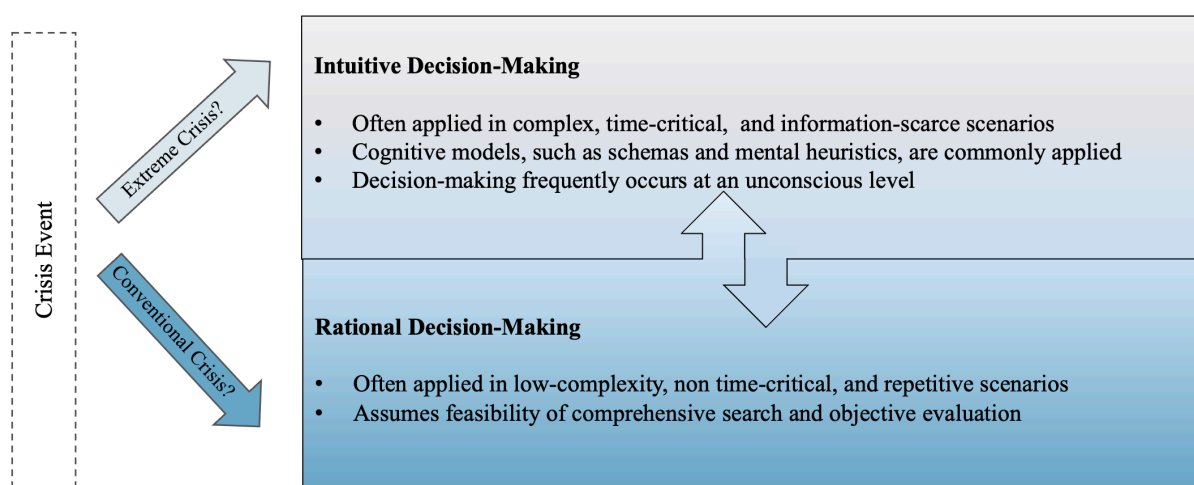


Figure 6: Application of rational and intuitive decision-making in CM (own representation)

Challenges in decision-making

As mentioned, although intuitive processes are vital for navigating highly uncertain crises, they also come with a substantial risk of failure (cf. Bonabeau 2003). Chermack (2004, 298) examined this issue and found that bounded rationality, stemming from the limitations of the mental abilities of human decision-makers (cf. Morecroft 1983, 133), often hinders their ability to make objective choices, thereby increasing the likelihood of failure (cf. Chermack 2004, 298). This issue is compounded using cognitive schemas, which can lead to the inclusion or exclusion of crucial information based solely on the decision-makers' cognitive abilities (cf. *ibid.*, 299-300).

Additionally, knowledge stickiness, often defined as the challenge of transferring information between individuals or groups, plays a significant role in decision-making, especially when

decisions require expertise or domain-specific knowledge (ibid). However, it should be noted that reducing knowledge stickiness can also diminish beneficial “friction,” which refers to the intricacies and cross-verification processes inherent in social interactions during work processes (ibid). Researchers stress the critical role of this friction, as rapid and automated processes lacking feedback and social interaction often result in a high error rate (ibid).

Applying the right skillset

Learning new skills is an integral part of professional development, but mastering decision-making abilities in crises poses unique challenges (cf. Snizek et al. 2002). The complexity of these scenarios requires not just knowledge acquisition but also the ability to effectively adapt to and manage high-pressure environments (ibid.). Decision-makers frequently face significant doubt and uncertainty in these high-stakes situations, where they must make quick, timely decisions amidst complex and demanding circumstances (cf. Al-Dabbagh 2020, 3).

During these challenges, possessing certain traits becomes crucial. These include coping with high levels of stress (cf. Jajčinović and Toth 2018, 129-136), maintaining situational awareness, employing critical thinking, and the capacity to make swift and efficient decisions (cf. Klein and Sullivan 2001). Moreover, decision-makers must articulate a clear vision of the problems to foster consensus and enhance the quality of the decision outcomes (cf. Al-Dabbagh 2020, 3-4).

Tools and techniques

When navigating complex scenarios in a dynamic environment with fragmented information, leveraging tools such as scenario planning, decision trees, or the Analytic Hierarchy Process (AHP) can enhance decision-making awareness and provide valuable insights (cf. Bhushan and Rai 2004, 5-26; Bryan 2009, 3-4). Scenarios offer descriptions of potential outcomes based on trends or events, aiding decision-makers in anticipating consequences and choosing appropriate courses of action (cf. Meyerowitz, Lew and Svensson 2018, 12). Decision trees enable a “longitudinal” approach by allowing decision-makers to explore various paths and outcomes

beyond the immediate decision (cf. Coles and Rowley 1995, 1-7). Furthermore, systematic methods such as AHP decompose problems into criteria and sub-criteria hierarchies, enabling decision-makers to systematically evaluate alternative solutions when faced with multiple conflicting criteria (cf. Bhushan and Rai 2004, 5-26).

Table 3: Overview of the variables shaping sense-making (own representation)

Variables shaping Sense-Making	
Tools and Techniques	Scenario Planning, Decision Trees, Systematic Methods (e.g. AHP)
Leadership Skills	Stress management, Situational Awareness, Critical Thinking, Vision Articulation (Problem Consensus)
Challenges	Knowledge Stickiness, "Friction" Management, Bounded Rationality, Cognitive Schemas (Biases)

In summary, the combination of tools and techniques, leadership abilities, and the presence of specific challenges (cf. Table 3) shape cognitive sense-making within both rational and intuitive decision-making, ultimately affecting the entire decision-making process and its outcomes (cf. Gasaway 2022). The insights obtained will establish a solid base for the forthcoming exploration of AI applications and their impacts, as discussed in Chapter 7.2.2.

7.2.2 Analysis of Potentials

Although the conducted interviews provided insights into AI's potential in crisis decision-making, most experts could not offer concrete examples of integration due to the nascent stage of AI implementation in this domain. To bridge these gaps in practical applications and further explore the potential, the operational options for AI integration were primarily identified through a systematic literature review and a simple keyword search (cf. Chapter 6.1; Appendix 1.2).

AI applications for decision-making preparatory stages

When asked about AI's greatest potential for decision-making in crises, most experts surveyed for this thesis pointed to its ability to process extensive data and perform crisis assessments (cf. E4; E6; E7; E8). They believe that these capabilities are key in providing crucial insights for

decision-making in CM (*ibid.*). Furthermore, they emphasized the potential of AI in mitigating biases and emotional attachments, as AI allows one to focus on the bigger picture problem rather than personal gain (cf. E7; E11). This perception is also reinforced by the European AI Alliance, which emphasizes the potential for AI to alleviate information overload and effectively filter out noise and misinformation (cf. Kazemi, 2023). With the ability to analyze, condense, and authenticate information from various sources, AI can identify causal relationships and assert suitable causes (cf. Kazemi, 2023; Jarrahi 2018, 5).

In addition, the impact of data processing and analysis also bears the potential to reduce knowledge stickiness, as it makes data interpretation less reliant on individuals, consequently lowering the associated costs of knowledge transfer (cf. Malekolkalami and Nazeri 2021, 4; Mar and Thaw 2019, 1448; “Meet Lilli, Our Generative AI Tool” 2023).

From an operational standpoint, one prevalent method of integrating such AI applications for seamless employee access to data processing tools is the utilization of chatbots (cf. Malekolkalami and Nazeri 2021, 1-4). Chatbots facilitate human-computer interaction through a conversational user interface, typically supporting text and voice communication, powered by technologies such as ML and NLP (cf. Malekolkalami and Nazeri 2021, 4).

In the context of AI’s impact on decision-making, Gurkan and Yan (2023) discovered that the early adoption of chatbots in decision-making processes can lead to a substantial improvement in decision-making performance, which can be attributed to enhanced cognitive diversity, indicating a greater variety of shared information, and increased information elaboration, reflecting more extensive information exchange and integration (cf. Gurkan and Yan, 2023).

Furthermore, the simplified sharing process of explicit knowledge stored in databases between individuals and across the organization via chatbots (cf. Malekolkalami and Nazeri 2021, 5) might, in turn, enable decision-makers to foster a more widespread consensus in their problem understanding, ultimately enhancing the quality of their decisions.

With the increasing capabilities of data processing, AI has also expanded its potential to generate various decision options and recommendations that allow for adaptation and feedback integration by the final decision maker (cf. Haleem, Javaid and Singh 2022, 3; E4; E7). McKinsey, for instance, recently launched their chatbot “Lilli” using LLM leveraged by internal and external resources to inform GenAI chat and NLP capabilities (cf. Franzen 2023). By leveraging these diverse technical complexes, “Lilli” can provide data-driven insights and specific recommendations for clients (cf. “Meet Lilli, Our Generative AI Tool” 2023).

Scenario planning is another use case for gaining recommendations, and testing and evaluating strategic decisions in dynamic situations. However, it is worth noting that this application is often employed proactively, even before a crisis emerges (cf. Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**). Scenario planning has also gained widespread use in contemporary thinking as a valuable tool for contemplating potential decision outcomes for business resilience (cf. Chermack and Lynham 2002, 12; E1; Table 3; Wilson 2000, 24). Especially when combined with GenAI, scenario planning enables efficient and timely testing of various possible decision outcomes within dynamic environments (cf. Finkenstadt et al. 2023). This complements decision-makers in generating, evaluating, and testing decisions effectively and efficiently (ibid.).

Beyond the integration of AI in scenario planning, researchers have also shown that the integration of AI within other strategic tools, such as in multi-criteria decision-making methods (cf. “AHP - systematic methods” Chapter 7.2.1), can enhance decision-making by providing efficient solutions to complex decision-making problems through ML solutions (cf. Ali et al. 2023, 1).

AI’s potential for executing highly data-driven and low-complexity scenarios

Although researchers suggest that it is unlikely for AI to thoroughly learn and replicate the personal experiences, subconscious processes, and human personality traits required in

complex situations (cf. Jarrahi 2018, 8), a few experts (cf. E4; E7) have highlighted AI's potential in data-driven decision-making scenarios. They argue that AI can offer an advantage in these situations, stating that "While this may be a novel situation for management or individuals, it is not for AI" (E4). This notion is supported by recent research revealing that when large sets of big data are available, the quality of decision-making is exceptionally high (cf. Bag et al. 2021, 178-179). Moreover, some research has already suggested that AI can excel in rational decision-making processes that do not require conscious and deliberative thinking (cf. Bag et al. 2021, 182). Furthermore, AI has shown promising results in domains such as media, justice, and healthcare, often performing on par with human decision-making or even surpassing it at times (cf. Araujo et al. 2020, 8). This highlights the potential for AI to outperform human decision-making under certain conditions.

7.2.3 Limitations

The findings from the analysis and discussion reveal numerous ways in which AI can support human beings in crisis decision-making. However, it is important to acknowledge that these findings also bring certain risks and limitations, specifically pertaining to the identified potentials of AI in decision-making.

Intellectual awareness and humility

Before integrating AI and taking advantage of its benefits in decision-making, managers need to have a general awareness that they cannot always be right and that the human mind is limited and influenced by biases, which can lead to less-than-ideal decisions (cf. E4; Rink and Ellemers 2010, 347). Furthermore, managers should be receptive to entrusting significant decision-making aspects to AI (cf. *Virtual Conference: The State of AI in Risk Management* 2023; Korteling et al. 2021, 1). Both of these steps require significant intellectual humility from top managers, which is often lacking in practice (ibid.).

In addition, trust is pivotal in establishing a practical collaborative framework between humans and AI in decision-making. It is notably shaped by the accuracy percentage presented alongside AI recommendations (cf. “Decision Making AI versus Humans” 2023), which, in turn, imposes additional requirements on the quality of the output generated by AI systems. Beyond the required transparency in output, managers also need to learn when it is appropriate to rely on AI for decisions and when human judgment is necessary (cf. Korteling et al. 2021, 10). Understanding the decision-making processes of AI, including how it “thinks” and reaches conclusions, becomes increasingly important as advanced AI systems gain greater autonomy (ibid.).

Legal considerations and accountability

Strategic decisions, especially those critical to CM, are naturally the responsibility of top management. However, it should also be noted that this responsibility includes the decision-making process and accountability for outcomes (cf. E13; Enarsson, Enqvist, and Naarttijärvi 2022). “If it was, for example, a cyber crisis, the CEO could be held responsible for specific actions, or for actions he has not taken, and face fines as [the head of] the company” (E5). Hence, top management can only partially exempt themselves from involvement when AI is integrated into decision-making (cf. E5).

Biases and incomplete data

Since the AI utilized in decision-making relies on historical data, inherent risks are associated with its outcomes (cf. Silberg and Manyika 2019, 3-6). While specific studies have indicated that AI has the potential to mitigate bias in decision-making, other research has highlighted the presence of inherent biases in AI-based decision systems, including gender or racial biases (cf. Lazaro, 2023; Nadeem, Marjanovic, and Abedin, 2022, 1; Silberg and Manyika 2019, 2). These risks arise from the potential that the models might be trained using data that includes human decisions or mirrors the secondary consequences of societal or historical inequalities (cf.

Silberg and Manyika 2019, 3-6). Consequently, the reduction of bias in AI becomes a crucial prerequisite for instilling trust in these systems (cf. Silberg and Manyika 2019, 6).

Moreover, depending entirely on automated learning processes to analyze data and to gather information can heighten the possibility of overlooking minor errors that would otherwise be identified through social “friction” (cf. Chermack and Lynham 2002, 299). This can result in catastrophic decision failures, which again highlights the significance of data dependence (ibid.). Furthermore, due to the lack of existing knowledge bases, AI faces constraints in generating recommendations and testing alternatives in novel situations under time pressure that require prompt reactions (cf. E4).

Human superiority

Although AI can provide information and give valuable recommendations based on data, humans are still superior when evaluating subjective and qualitative matters that require a nuance not shown in data (cf. Jarrahi 2018, 8; E1; E7). Expert 7, for instance, noted that “if we always made decisions just on data, it might give us the best recommendation, but sometimes there are other non-data-driven factors that may lead us to a different decision,” implying the need for the inclusion of non-data-driven dimensions when making decisions.

In line with this recognition of non-data-driven nuances, the experts also emphasized the influence of leadership skills during crises, which is a dimension that AI cannot replicate (cf. E4; E7). The capacity to address subjective and qualitative matters, including norms, social dynamics, and contextual factors, for instance, often necessitates a level of sense-making that the current AI systems are often not equipped for in decision-making (cf. Jarrahi 2018, 8; Korteling et al. 2021; 9; E1; E7). More practically, human judgment is often required when AI-based recommendations are challenged (cf. *Virtual Conference: The State of AI in Risk Management* 2023). For instance, “Lilli”, the McKinsey chatbot, mainly aims to act as a co-pilot in decision-making while leaving characteristics such as judgment and creativity to

humans (cf. Musliu 2023). Finally, given the complexity of decision-making, it is evident that until there is more trust in machines, humans have a strong preference for having a person responsible for making the final decision rather than solely relying on AI, underscoring the essential need for human involvement in the decision-making loop (cf. E4).

7.2.4 Discussion and Derivation of Applications

Based on the results of the applied analysis, two areas of AI application have become evident, namely the involvement of **AI-based approaches in the decision-making preparatory stages**, specifically **within the domains of information gathering, recommending, and evaluating decision options**, and the use of **AI in low-complexity, data-driven automated decision-making**, resulting in a total of four applications.

To ensure alignment with the overarching research question, “Can AI integration in CM enhance a company’s crisis response and resilience?” AI applications were considered when they held the potential to enhance existing decision-making determinants and processes.

AI applications for decision-making preparatory stages

Despite challenges such as integrating non-data-driven information and the risk of biased data, AI's potential in various domains is substantial (cf. Chapter 7.2.2). It can effectively reduce knowledge stickiness and enhance information sharing (ibid.). Additionally, AI plays a pivotal role in diminishing biases, particularly when proactive steps are taken to address data perception biases (cf. Chapter 7.2.3). AI also yields the potential to aid in consensus-building within problem-solving contexts (cf. Chapter 7.2.2). Consequently, leveraging AI's advantages in the information-gathering and problem-understanding phases of decision-making, notably through tools like internal chatbots (ibid.), leads to the conclusion that:

- 1) *By employing GenAI in tools such as chatbots for internal use, AI can empower decision-makers to gather information and understand problems by analyzing causal relationships and simplifying the root causes in data.*

Furthermore, despite being limited in new situations (cf. Chapter 7.2.3), the integration of AI in chatbots, scenario planning, and multi-criteria decision-making was shown to have the potential to generate alternative decision options and test different approaches for enhanced evaluation (ibid.). This integration effectively balances AI's analytical capabilities with human strengths like judgment and creativity (ibid.). Given the enhancement and support in generating recommendations and testing alternatives for better evaluation, it can be argued that:

- 2) *By incorporating ML in multi-criteria decision-making methods and GenAI in chatbots or scenario planning, AI can generate diverse options and alternatives.*
- 3) *By integrating GenAI into chatbots or strategic tools such as scenario planning, AI can enable rapid testing, adaptation, and feedback for diverse decision outcomes in dynamic environments.*

AI in low-complexity, data-driven automated decision-making

While certain sources (cf. E8; E10; E12; E2) indicate that AI faces limitations in complex and novel situations and cannot supplant human judgment, other sources (cf. E4; E7) have considered the possibility of AI taking over data-driven and repetitive decision-making tasks in CM. Nevertheless, this integration of AI into CM must carefully consider legal requirements and subtle aspects that extend beyond data reliance (cf. Chapter 7.2.3). Acknowledging these factors leads to the potential application of AI in enhancing automated decision-making, specifically in scenarios that are data-driven and conventional within the context of CM:

- 4) *AI can facilitate automated decision-making in data-intensive and low-complexity (repetitive) crisis scenarios.*

Considering the applications identified in this section, it is important to recognize that the depth of the findings can vary. On one hand, the integration of AI in support roles is related to evident applications, suggesting potential tools and techniques for integration, as well as emphasizing the advantages of specific AI branches that should be utilized. On the other hand, the integration of automated crisis decision-making in data-driven environments is still in a relatively preliminary stage and does not specify any particular integration of AI in tools, techniques, or specific fields of AI for utilization. Furthermore, considering the specific limitations, it is important to note that the relevance of these applications varies, especially in the context of extreme crisis scenarios. Moreover, it is essential to consider the level of AI autonomy and its impact on human involvement. Taking these limitations into account Figure 7 presents an extensive overview of AI applications, classified by their viability in extreme situations and the levels of autonomy they entail. This aligns with the AI autonomy model detailed in Chapter 4.2. The evaluation is informed by the detailed analysis in Chapter 7.2.2 and the identified limitations in Chapter 7.2.3 and is further substantiated by expert assessments referenced in Appendix 4.2.

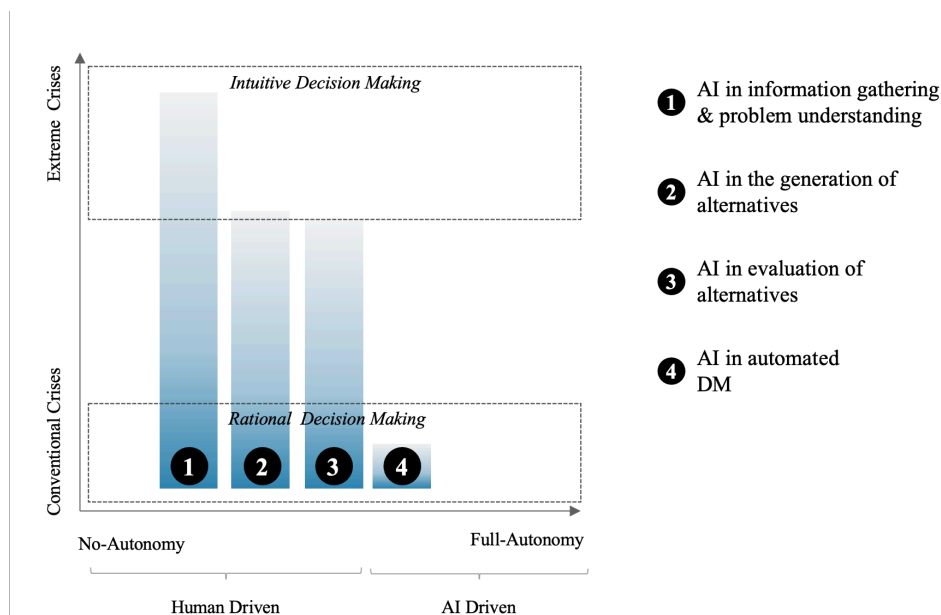


Figure 7: Allocation of decision-making applications in terms of their autonomy levels and applicability in extreme scenarios (own representation)

As illustrated in Figure 7, AI's adaptability in information gathering and problem understanding is likely to extend to various scenarios, including extreme ones. This capability can be attributed to AI's proficiency in processing existing data, thereby reducing its dependency on acquiring new data (cf. Chapter 7.2.2; Chapter 7.2.3). However, as a significant level of human involvement is still essential to efficiently manage and analyze the data for decision-making, it is essential to underscore that AI primarily serves as assistance with a relatively limited degree of autonomy. Furthermore, human intervention plays a crucial role in addressing nuances and insights that may not be immediately apparent in the data (cf. Chapter 7.2.3).

When evaluating the use of AI for both the generation of alternative options and the assessment of these alternatives, it is important to consider that its effectiveness often faces constraints in extreme scenarios. These limitations stem from the complexity of the situations and the restrictions imposed by database limitations (ibid.). Nevertheless, AI excels in suggesting alternatives, offering recommendations for decision-making, and assessing potential options, leading to low to moderate levels of autonomy in decision-making. Despite these benefits, the role of human judgment and additional assessment remains crucial and irreplaceable, especially when it comes to evaluating outcomes (ibid.).

Finally, applying AI in automated decision-making primarily applies to conventional crises, as AI relies on a broad knowledge base to function effectively (ibid.). Human participation is minimal, yet essential for oversight, ensuring compliance with legal mandates and addressing the nascent trust in AI decision-making, indicative of a need for moderate to high autonomy (ibid.).

Overall, AI's strengths lie in managing conventional crises and facilitating rational decision-making (cf. Figure 7). However, its efficacy diminishes in situations requiring intuitive decision-making, a limitation that becomes more evident as AI assumes greater autonomy in

decision-making. Nevertheless, the dynamic interplay between rational and intuitive decision-making (cf. Figure 6), AI's insights, though limited, can still provide valuable guidance in challenging scenarios.

The study also underscores a wider challenge for AI in decision-making: the necessity of both technological advancements, particularly in addressing biases and filling gaps in data, and a shift in human attitudes toward AI. For AI to be more effectively integrated into decision-making, there needs to be a foundation of trust in AI, bolstered by its transparency (cf. Chapter 7.2.3). Additionally, managers must recognize and accept their own cognitive limitations to facilitate the future implementation and integration of AI in decision-making, especially in CM (ibid.).

This research supports an augmented approach to decision-making in CM, where AI is utilized not only as a technological tool but also as a collaborative partner in the decision-making process.

7.3 ///

7.4 ///

8 Conclusion

8.1 Summary of the Findings

In pursuit of the overarching research question, four distinct analyses were carried out in the domains of ED&P decision-making, SI&C, and OL. These analyses employed a Qualitative Interview approach and Systematic Literature Review to explore the query: "Can the integration of AI in CM contribute to improving a company's response to future crises and, in turn, fortify its resilience?" The ensuing discussion will center on the three formulated hypotheses as outlined below.

Table 4: Overview of findings (own representation)

AI Applications		Applicability within different Crisis Scenarios (Conventional Crisis = Low – Extreme Crisis = High)	Autonomy Level*	Operational Integration
Early Detection and Preparation	AI-Driven Data Collection	Moderate to High	Low	Scenario Building, Forecasting (Tools: Everbridge, Ava...)
	Automated Data Processing	Moderate to High	Low to Moderate	Forecasting, Scenario Building, Contingency Planning (Tools: Everbridge, Ava...)
	AI-Driven attack countermeasures	Moderate	High	Contingency Planning
	AI in Immediate Crisis Response Systems	Low to Moderate	Moderate to High	Chatbots, Contingency Planning
Decision Making	AI in Information Gathering and Problem Understanding	High	Low	Chatbots
	AI in Generation of Alternative Options	Moderate	Low	Chatbots, Scenario Planning, Multi-Criteria Decision-Making Methods
	AI in Evaluation of Alternatives	Moderate	Low to Moderate	Scenario Planning
	AI in Automated Decision-Making	Low	Moderate to High	/
Strategy Implementation	AI in Generation of Crisis Response Statements	High	Low	Chatbots
	AI in Assistance chatbots for first Response	Low	Moderate to High	Chatbots
	AI in Selection of CMT Members	Low	Moderate	/
	AI in Automating Back-Office Tasks in Project Management	High	Full	Third-Party Solutions (Asana, Trello, and Basecamp)
	AI in Identifying and Developing pertinent KPIs	Moderate	Low	/
Organizational Learning	AI in Data Collection	Moderate to High	Moderate to High	Automated Data Backups
	AI in Structuring and Analysing Data	Low to Moderate	Low to Moderate	After Action Reviews
	AI in Reflection and Planning	Low to Moderate	Low	Reflection Training within Retrospective Teams
	AI in Automating Training KPIs	Low to Moderate	Low	Chatbots and NLP-Systems

**For simplicity applications might be shorted and AI branches are summarized under the umbrella of AI*

H1: The effectiveness of AI in CM is limited, especially in extreme scenarios. Furthermore, AI applications exhibit varying degrees of autonomy, indicating differences in overall AI autonomy levels.

While some applications demonstrate potential applicability in extreme crisis scenarios, as seen in decision-making and SI&C, the overall results indicate limited usability when applying them in extreme scenarios. Several possible reasons contribute to this outcome:

*AI heavily relies on historical data, which makes it challenging to adapt to new and unprecedented situations (cf. Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**; Chapter 7.2.3).*

AI has inherent limitations in imitating human behaviors, particularly emotions and empathy (cf. Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**; Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**).

The emergence of biases and restricted data access exacerbates the issue of liability significantly (cf. Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**; Chapter 7.2.3; Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**; Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**)

The most significant indications of AI autonomy levels are evident in the realm of SI&C, particularly in the context of AI automating back-office tasks in PM.

However, in areas like ED&P, decision-making, and OL, moderate to high levels of autonomy are also evident.

Notably, AI, especially in domains focused on repetitive tasks such as automating back-office tasks in PM, exhibits noteworthy efficacy even in extreme scenarios. Contrastingly, instances of high AI autonomy find limited applicability and are predominantly constrained to low to moderate crisis scenarios in most other contexts. Additionally, it's important to note that data collection can result in varying degrees of autonomy, depending on the specific environment in which it is implemented. For instance, in the context of ED&P, AI-assisted data collection doesn't achieve a high level of autonomy, as this step mainly represents the pure generation of

data without AI executing any own decisions or actions (cf. Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**).

Despite the exception of AI in automated back-office tasks, the overall findings underscore that, in most cases, AI applications do not completely replace the responsibilities of human executives and are depending on the complexity of the crisis environment. Therefore, **H1 can be supported.**

H2: The integration of AI in CM is anticipated to yield diverse applications and potentials across various phases, influencing detection and prevention, decision-making, SI&C, and OL. Considering the limitations outlined in this study, it is evident that various aspects focusing on different aspects of CM have the potential to reap several benefits through the integration of AI. However, it should be noted that the depth and specificity of these benefits may vary. Despite these differences, **H2 can be supported** as the research indicates that AI can yield diverse applications and potentials across various phases of CM, influencing detection and prevention, decision-making, strategy control, and OL.

H3: AI applications can be effectively implemented at an operational level.

While numerous potentials for AI integration were identified, not all applications could be traced to an operational level. For disciplines such as decision-making, SI&C, and OL, concrete paths for AI integration were not always evident for at least one of the applications within these areas. As a result, **H3 can only partially be supported.**

In summary, the findings strongly indicate that AI integration is not only feasible but also holds significant potential to enhance worker productivity, bolster business resilience, and thus provide a competitive advantage by freeing capacity of top managers to focus on the most relevant task, reduce errors and to increase speed in crisis response (cf. Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.;** Chapter 7.2.2; Chapter **Fehler!**

Verweisquelle konnte nicht gefunden werden.; Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**).

8.2 Constraints of AI Applications and Future Development

While AI shows promise in supporting humans, limitations become apparent when facing extreme crisis scenarios (cf. Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.;** Chapter 7.2.3). Acquiring high-quality training and real-world data for instance, especially during infrequent crises, presents a significant challenge, particularly affecting the ED&P and decision-making phase, where data collection and processing form the bedrock for further actions and decision-making. Efforts to overcome this challenge involve categorizing crisis factors into classes, which in turn can potentially lead to overgeneralizations and subsequent quality concerns (cf. Mansouri-Benssassi 2023). Another obstacle that arises in data processing within the applications is the challenge of addressing biases in data. Biases infiltrating AI applications, stemming from the data collection phase, result in unjust outcomes.

AI also exhibits limitations in human interaction, which includes critical elements like empathy and intelligence. These are essential for effectively conveying vital messages during crises, such as communicating about job losses or instilling trust in decision-making processes (cf. Chapter 7.2.3 and Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**). They are also crucial in post-crisis company restructuring and filtering pertinent information for decision-making, as discussed in Chapter 7.2.2 Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.,** and Chapter **Fehler! Verweisquelle konnte nicht gefunden werden..**

These restrictions primarily stem from the nature of ANI, the most common type of AI today (cf. Chapter 4.1) which excels in specialized tasks but is restricted to a limited scope (Glenn 2022). ANI demonstrates human-like cognitive skills, but only within narrowly defined areas (ibid.).

Beyond the evident barriers that limit the application of the AI applications identified in this thesis, it is crucial to consider broader factors relevant to the incorporation of AI.

Like many other business processes, CM necessitates skilled staff, specialized knowledge, and significant computational resources for AI integration. Economic feasibility, especially in the short term, is a particular challenge for small and medium-sized businesses. To overcome technical and resource issues, some firms turn to third-party software, which brings its own set of challenges. These include concerns about privacy and security, lack of clarity in the software's workings, and difficulties in adapting LLMs that rely on general datasets (cf. Bartneck et al. 2021, 63). Additionally, the risk of data breaches and the potential misuse of sensitive information further complicate these challenges and needs to be considered in the applications.

Nonetheless, it is imperative to acknowledge that these limitations are inherent to the current state of research. The potential for future research and technological advancements holds promise for mitigating some of these limitations but also carries the possibility of introducing new constraints to the identified applications.

The constraints introduced by biases, for instance, have already been acknowledged and are being addressed by proactive companies like Google, which places a high priority on implementing measures to mitigate such biases (cf. Minikus 2022).

Future exploration should also focus on innovative investigative avenues, allocating resources to enhance training data quality to mitigate biases. Nadeem, Abedin, and Marjanovic (2020) for instance, stress the significance of incorporating broader societal diversity and inclusivity within data sets, along with a commitment to fairness throughout the development of AI systems itself (ibid.). This involves the implementation of real-time or periodic checks to identify and rectify potential errors, shifts in data patterns, or emerging biases (ibid.).

Looking ahead, sustaining and advancing progress in AI requires increased investment, collaborative data-sharing, and ongoing interdisciplinary engagement, with a key focus on continuously evaluating the evolving role of AI decision-making in real-world applications (cf. Manyika 2019).

Another future consideration also lies in the global regulations on AI and responsible AI, with the proposal of the "Artificial Intelligence Act" in Europe pending formal approval (European Commission 2023). Legal interpretation assistance and AI's impact on employment are closely linked to CM and considered high-risk AI, potentially constraining applications. High-risk AI requires specific data governance, including representative data and designated human oversight (human in the loop), presenting challenges in obtaining representative data and limiting automation capabilities (ibid.).

Furthermore, while integration options may not be universally available yet (cf.

Table 4) companies such as Microsoft and Google have announced plans to incorporate AI into their existing systems, highlighting the necessity for managers to thoroughly understand and engage with the limitations and risks associated with AI (cf. Metz 2023).

As not only the integration of AI evolves but also the development of AI itself, the transition towards AGI becomes a significant consideration (cf. Chapter 4.1). AGI is envisioned to emulate and surpass human reasoning abilities across many areas (cf. Metz 2023), addressing limitations identified in this study. The surpassing of human capabilities prompts inquiries into its potential, control mechanisms, public trust, and transparency, as this study underscores the imperative of increased transparency in AI-driven automated decisions (cf. Chapter 7.2.3).

It's worth considering whether AGI (cf. "Artificial General Intelligence" Chapter 4.1) can be examined for its ability to address aspects like empathy in crisis response statements or whether AGI might also have the capability to discern human nuances that are not readily apparent in data and allow for more liability in decision-making (cf. Chapter 7.2.3; Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**).

The development of AGI remains largely theoretical (cf. Chapter 4.1), giving rise to several essential questions. Firstly, it is important to consider the extent of AI's power, especially in light of the formidable potential of AGI (ibid.). Secondly, the ability to regulate or confine AGI's influence is crucial in averting adverse outcomes (ibid.). Lastly, the degree to which individuals will place their trust in AGI systems and their decision-making processes is a noteworthy consideration (cf. Korteling et al. 2021; Metz, 2023).

Taking the future landscape into consideration, the prevailing insights underscore the auxiliary role of AI during crises. This specifically underlines the significance of maintaining low to medium levels of AI autonomy and ensuring that management remains predominantly human-led (cf.

Table 4). Nonetheless, given the rise of new developments it is strongly recommended that crisis managers and management teams integrating AI into their CM strategies stay abreast of ongoing changes and developments in AI to bolster long-term business resilience.

9 Study Limitations

Recognizing potential bias in survey design is paramount, given the potential influence of specific questions on respondent perspectives. Mitigation efforts, including semi-guided interviews and neutral wording, were implemented. Despite endeavors to ensure a comprehensive industry-wide perspective, the limitation arises from a small expert sample size of 16, rendering their opinions not necessarily representative of the broader population. For further research, augmenting the research through open-ended and semi-guided interviews would afford unbiased insights into personal experiences and events, enhancing the depth of the findings. An alternative approach involves integrating speeches, allowing experts to express their viewpoints without steering freely.

Furthermore, due to expert selection, the study introduces potential bias attributed to the geographic concentration of experts in Europe, Australia, and North America. Incorporating socio-demographic variables such as age, gender, and nationality as controls would introduce realism and diversity. Exploring experts' opinions from Asia, South America, and Africa, particularly from advanced AI states like China, Japan, and South Korea, could offer valuable insights into future research.

Another study limitation is the need for more statistically relevant insights for back-testing and verifying identified applications. The questionnaire's distribution is confined to a limited pool

of experts, suggesting the need to increase awareness of the findings in relevant CM and business resilience conferences. This strategic move aims to augment participant numbers, facilitating statistically supported derivation of study findings.

While the research diversified the experts' backgrounds, the study's focus on identifying general applications restricted the exploration of correlations between company characteristics and AI tool usage. Further research studies should investigate how company size and location impact AI applicability in CM and could yield valuable insights as the size and form of a company, whether a startup or a large corporation, could significantly influence the integration of AI tools in CM. The composition, expertise, and background of experts might impact AI development progression, prompting the need for future research to comprehend the influence of organizational structures and business models on AI adoption and effectiveness in managing crises. Despite interviewing specialists in CM and AI, establishing a consistent link between AI tools and their application in CM proved challenging.

A notable limitation of this study is the need to examine the correlation between specific crisis phases and the effects of AI implementation within those phases. The literature shows the potential influence of interrelationships between the four phases. As evidenced in previous studies (cf. Rizzo et al. 2012), virtual simulations have demonstrated efficacy in significantly enhancing stress resilience. This enhancement could positively impact managers' crisis awareness, decision-making process, and team leadership capabilities during acute crises (cf. Rizzo et al. 2012; Chapter Fehler! Verweisquelle konnte nicht gefunden werden., Chapter 7.2.1, Chapter Fehler! Verweisquelle konnte nicht gefunden werden.). Consequently, integrating AI into learning simulations influences the broader landscape of interconnected skills and knowledge. A more thorough analysis of correlations and interdependencies holds substantial potential for future research.

Finally, the research and the development of applications are predicated upon contemporary state-of-the-art practices and regulatory mandates. This approach underscores the importance of integrating up-to-date information, which is pivotal for enhancing the efficacy and relevance of future scholarly inquiries and applications.

VI Bibliography

**Please find sources for individual parts in the separate sections marked by student names*

- 'T Hart, Paul, Liesbet Heyse, and Arjen Boin. 2001. "New Trends in Crisis Management Practice and Crisis Management Research: Setting the Agenda." *Journal of Contingencies and Crisis Management* 9 (4): 181–88. <https://doi.org/10.1111/1468-5973.00168>.
- Abid, Sheikh Kamran, Noralfishah Sulaiman, Shiau Wei Chan, Umber Nazir, Muhammad Abid, Heesup Han, Antonio Ariza-Montes, and Alejandro Vega-Muñoz. 2021. "Toward an Integrated Disaster Management Approach: How Artificial Intelligence Can Boost Disaster Management." *Sustainability* 13 (22): 12560. <https://doi.org/10.3390/su132212560>.
- Adcock, Philipp. 2023. "6 Limitations of AI & Why It Won't Quite Take Over In 2023!" January 26, 2023. <https://www.adcocksolutions.com/post/6-limitations-of-ai-why-it-wont-quite-take-over-in-2023>.
- Ahlstrom et al. n.d. "Performance Management in Times of Crisis - HR Strategies - IsoTalent." Accessed December 6, 2023. <https://www.isotalent.com/performance-management-in-times-of-crisis-hr-strategies>.
- alexandre. 2023. "Artificial Intelligence : Definition, History and Risks." *Data Science Courses | DataScientest* (blog). January 9, 2023. <https://datascientest.com/en/artificial-intelligence-definition>.
- Alfonseca, Manuel, Manuel Cebrian, Antonio Fernandez Anta, Lorenzo Coviello, Andrés Abeliuk, and Iyad Rahwan. 2021. "Superintelligence Cannot Be Contained: Lessons from Computability Theory." *Journal of Artificial Intelligence Research* 70 (January): 65–76. <https://doi.org/10.1613/jair.1.12202>.
- Alharbi, Ayman, and Md Abdur Rahman. 2021. "Review of Recent Technologies for Tackling COVID-19." *SN Computer Science* 2 (6): 460. <https://doi.org/10.1007/s42979-021-00841-z>.
- Araujo, Theo, Natali Helberger, Sanne Kruijkemeier, and Claes H. De Vreese. 2020. "In AI We Trust? Perceptions about Automated Decision-Making by Artificial Intelligence." *AI & SOCIETY* 35 (3): 611–23. <https://doi.org/10.1007/s00146-019-00931-w>.
- Ashrafi, Hutan. 2015. "Artificial Intelligence and Robot Responsibilities: Innovating Beyond Rights." *Science and Engineering Ethics* 21 (2): 317–26. <https://doi.org/10.1007/s11948-014-9541-0>.
- Baesens, Bart, Rudy Setiono, Christophe Mues, and Jan Vanthienen. 2003. "Using Neural Network Rule Extraction and Decision Tables for Credit-Risk Evaluation." *Management Science* 49 (3): 312–29. <https://doi.org/10.1287/mnsc.49.3.312.12739>.
- Bakacsi. 2012. "MANAGING CIRISIS: SINGLE-LOOP OR DOUBLE-LOOP LEARNING?" https://www.researchgate.net/publication/249961118_MANAGING_CIRISIS_SINGLE-LOOP_OR_DOUBLE-LOOP_LEARNING.
- Bakhtiari, Ahad, Amirhossein Takian, Afshin Ostovar, Masoud Behzadifar, Efat Mohamadi, and Maryam Ramezani. 2023. "Developing an Organizational Capacity Assessment Tool and Capacity-Building Package for the National Center for Prevention and Control of Noncommunicable Diseases in Iran." Edited by Samane Shirahmadi. *PLOS ONE* 18 (6): e0287743. <https://doi.org/10.1371/journal.pone.0287743>.
- Bărbulescu, Oana, Alina Simona Tecău, Daniel Munteanu, and Cristinel Petrișor Constantin. 2021. "Innovation of Startups, the Key to Unlocking Post-Crisis Sustainable Growth in Romanian Entrepreneurial Ecosystem." *Sustainability* 13 (2): 671. <https://doi.org/10.3390/su13020671>.
- Batin, Michael, Alexey Turchin, Sergey Markov, Alisa Zhila, and David Denkenberger. 2017. "Artificial Intelligence in Life Extension: From Deep Learning to

- Superintelligence.” *Informatica*, December. <https://research.ibm.com/publications/artificial-intelligence-in-life-extension-from-deep-learning-to-superintelligence>.
- Batinic, Bernad, and Markus Appel. 2008. *Medienpsychologie*. Springer-Lehrbuch. Heidelberg: Springer.
- Behnke, Nathalie, and Steffen Eckhard. 2022. “A Systemic Perspective on Crisis Management and Resilience in Germany.” *Dms – Der Moderne Staat – Zeitschrift Für Public Policy, Recht Und Management* 15 (1–2022): 3–19. <https://doi.org/10.3224/dms.v15i1.11>.
- Bharadiya, Jasmin. 2023. “The Impact of Artificial Intelligence on Business Processes.” *European Journal of Technology* 7 (2): 15–25. <https://doi.org/10.47672/ejt.1488>.
- Björck, Alben. 2016. “Crisis Typologies Revisited: An Interdisciplinary Approach.” *Central European Business Review* 5 (3): 25–37. <https://doi.org/10.18267/j.cebr.156>.
- Bogner, A., B. Littig, and W. Menz. 2014. *Interviews Mit Experten*. Wiesbaden: Springer VS.
- Boin, Arjen, and Patrick Lagadec. 2000. “Preparing for the Future: Critical Challenges in Crisis Management.” SSRN Scholarly Paper. Rochester, NY. <https://papers.ssrn.com/abstract=2196866>.
- Boin, Arjen, Paul ’T Hart, Eric Stern, and Bengt Sundelius. 2005. *The Politics of Crisis Management: Public Leadership Under Pressure*. 1st ed. Cambridge University Press. <https://doi.org/10.1017/CBO9780511490880>.
- Bortz, V., and N. Döring. 2006. *Forschungsmethoden Und Evaluation Für Human- Und Sozialwissenschaftler*. Vol. 4. Heidelberg: Springer VS.
- Bostrom, Nick. 2014. *Superintelligence - Paths, Dangers, Strategies*. 1st ed. Oxford: Oxford University Press. https://www.amazon.com/Superintelligence-Dangers-Strategies-Nick-Bostrom/dp/0199678111/ref=tmm_hrd_swatch_0?_encoding=UTF8&qid=1699636904&sr=1-1.
- . 2017. “Strategic Implications of Openness in AI Development.” *Global Policy* 8 (2): 135–48. <https://doi.org/10.1111/1758-5899.12403>.
- Bradfield, Ron, George Wright, George Burt, George Cairns, and Kees Van Der Heijden. 2005. “The Origins and Evolution of Scenario Techniques in Long Range Business Planning.” *Futures* 37 (8): 795–812. <https://doi.org/10.1016/j.futures.2005.01.003>.
- Brodsky, Sascha. 2023. “How AI Can Cause a Financial Crisis.” November 7, 2023. <https://aibusiness.com/responsible-ai/how-ai-could-cause-a-market-crash#close-modal>.
- Buber, R., and H. Holzmüller. 2009. *Qualitative Marktforschung*. Vol. 2. GWV Fachverlag GmbH.
- Bundy, Jonathan, Michael D. Pfarrer, Cole E. Short, and W. Timothy Coombs. 2017. “Crises and Crisis Management: Integration, Interpretation, and Research Development.” *Journal of Management* 43 (6): 1661–92. <https://doi.org/10.1177/0149206316680030>.
- Burnett, John J. 1998. “A Strategic Approach to Managing Crises.” *Public Relations Review* 24 (4): 475–88. [https://doi.org/10.1016/S0363-8111\(99\)80112-X](https://doi.org/10.1016/S0363-8111(99)80112-X).
- Carmeli, Abraham, and John Schaubroeck. 2008. “Organisational Crisis-Preparedness: The Importance of Learning from Failures.” *Long Range Planning* 41 (2): 177–96. <https://doi.org/10.1016/j.lrp.2008.01.001>.
- Carrera-Ruvalcaba, Ernesto, Johnson Ekedum, Austin Hancock, and Ben Brock. 2019. “Leveraging Natural Language Processing Applications and Microblogging Platform for Increased Transparency in Crisis Areas.” *SMU Data Science Review* 2 (1). <https://scholar.smu.edu/datasciencereview/vol2/iss1/6>.
- Castro, Daniel. 2023. “Ten Principles for Regulation That Does Not Harm AI Innovation.” Information Technology & Innovation Foundation. <https://itif.org/publications/2023/02/08/ten-principles-for-regulation-that-does-not-harm-ai-innovation/>.

- Chayanuvat, Anchalee, and Ailan Yuan. 2021. "A Study on the Difference between Organizational Learning And Learning Organization" 4 (4). <https://www.ijassjournal.com/2021/V4I4/4146575833.pdf>.
- Chen, Yasheng, and Mohammad Islam Biswas. 2021. "Turning Crisis into Opportunities: How a Firm Can Enrich Its Business Operations Using Artificial Intelligence and Big Data during COVID-19." *Sustainability* 13 (22): 12656. <https://doi.org/10.3390/su132212656>.
- Chowdhary, K.R. 2020. *Fundamentals of Artificial Intelligence*. New Delhi: Springer India. <https://doi.org/10.1007/978-81-322-3972-7>.
- Chui, Michael, Roberts Roger, Lareina Yee, and Hazan Eric. 2023. "The Economic Potential of Generative AI: The next Productivity Frontier." *McKinsey and Company*, June. <https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-economic-potential-of-generative-ai-the-next-productivity-frontier>.
- Coccia, Mario. 2020. "Critical Decisions in Crisis Management: Rational Strategies of Decision Making." SSRN Scholarly Paper. Rochester, NY. <https://papers.ssrn.com/abstract=3651245>.
- Coombs, W. Timothy. 1995. "Choosing the Right Words: The Development of Guidelines for the Selection of the 'Appropriate' Crisis-Response Strategies." *Management Communication Quarterly* 8 (4): 447–76. <https://doi.org/10.1177/0893318995008004003>.
- Coombs, W Timothy. 2007. "Protecting Organization Reputations During a Crisis: The Development and Application of Situational Crisis Communication Theory." *Corporate Reputation Review* 10 (3): 163–76. <https://doi.org/10.1057/palgrave.crr.1550049>.
- Coombs, W. Timothy, and Sherry J. Holladay, eds. 2010. *The Handbook of Crisis Communication*. Handbooks in Communication and Media. Chichester, U.K. ; Malden, MA: Wiley-Blackwell.
- Coombs, W.Timothy. 2012. "Deep and Surface Threats: Conceptual and Practical Implications for 'Crisis' vs. 'Problem.'" *Public Relations Review* 28 (4): 339–45. [https://doi.org/10.1016/S0363-8111\(02\)00167-4](https://doi.org/10.1016/S0363-8111(02)00167-4).
- Dahles, Heidi, and Titi Prabawa Susilowati. 2015. "Business Resilience in Times of Growth and Crisis." *Annals of Tourism Research* 51: 34–50. <https://doi.org/10.1016/j.annals.2015.01.002>.
- Daneshjou, Roxana, Mary Smith, and Mary D. Sun. n.d. "Lack of Transparency and Potential Bias in Artificial Intelligence Data Sets and Algorithms." *JAMA Dermatol*. Accessed October 11, 2023. <https://jamanetwork.com/journals/jamadermatology/article-abstract/2784295>.
- Domala, Jayashree, Manmohan Dogra, Vinit Masrani, Dwayne Fernandes, Kevin D'souza, Delicia Fernandes, and Tejal Carvalho. 2020. "Automated Identification of Disaster News for Crisis Management Using Machine Learning and Natural Language Processing." In *2020 International Conference on Electronics and Sustainable Communication Systems (ICESC)*, 503–8. Coimbatore, India: IEEE. <https://doi.org/10.1109/ICESC48915.2020.9156031>.
- Domingos, Pedro. 2012. "A Few Useful Things to Know about Machine Learning." *Communications of the ACM* 55 (10): 78–87. <https://doi.org/10.1145/2347736.2347755>.
- Dong, Xin Luna, Seungwhan Moon, Yifan Ethan Xu, Kshitiz Malik, and Zhou Yu. 2023. "Towards Next-Generation Intelligent Assistants Leveraging LLM Techniques." In *Proceedings of the 29th ACM SIGKDD Conference on Knowledge Discovery and Data Mining*, 5792–93. KDD '23. New York, NY, USA: Association for Computing Machinery. <https://doi.org/10.1145/3580305.3599572>.
- Duan, Yanqing, John S. Edwards, and Yogesh K Dwivedi. 2019. "Artificial Intelligence for Decision Making in the Era of Big Data – Evolution, Challenges and Research Agenda." *International Journal of Information Management* 48: 63–71. <https://doi.org/10.1016/j.ijinfomgt.2019.01.021>.

- Eitel-Porter, Ray, Marisa Tricarico, and Rossana Ianchi. 2023. "Responsible AI: Scale AI with Confidence." Accenture. <https://www.accenture.com/us-en/services/applied-intelligence/ai-ethics-governance>.
- El-Said, Osman Ahmed, Michael Smith, Yasser Al-Yafaei, and Shekha Aal Abdul Salam. 2023. "From Complexity to Evolution: Mapping Resilience Management Practices in the Hospitality Industry during the COVID-19 Crisis." *International Journal of Hospitality Management* 110: 103435. <https://doi.org/10.1016/j.ijhm.2023.103435>.
- Essien, Aniekan Emmanuel, and Ilias Petrounias. 2022. "An Artificial Intelligence (AI)-Based Decision-Making Framework for Crisis Management." In *Advances in Electronic Government, Digital Divide, and Regional Development*, edited by Mohammed Ali, 84–98. IGI Global. <https://doi.org/10.4018/978-1-7998-9815-3.ch007>.
- European Parliament. 2023. "EU AI Act: First Regulation on Artificial Intelligence." European Parliament. https://www.europarl.europa.eu/news/en/headlines/society/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence?&at_campaign=20226-Digital&at_medium=Google_Ads&at_platform=Search&at_creation=RSA&at_goal=TR_G&at_advertiser=Webcomm&at_audience=ai%20act&at_topic=Artificial_intelligence_Act&at_location=DE&gclid=Cj0KCQjw4vKpBhCZARIsAOKHoWQtCCfS1YhYNJ2MsXbNjsx-Wi3ULEsUwWux8mq7nwSLLlinNO8Jk0aAkVSEALw_wcB.
- Fardian, Denny. 2023. "5 Biggest Limitations of Artificial Intelligence." Glare.AI. <https://glair.ai/post/5-biggest-limitations-of-artificial-intelligence>.
- Farrokhi, Aydin, Farid Shirazi, Nick Hajli, and Mina Tajvidi. 2020. "Using Artificial Intelligence to Detect Crisis Related to Events: Decision Making in B2B by Artificial Intelligence." *Industrial Marketing Management* 91: 257–73. <https://doi.org/10.1016/j.indmarman.2020.09.015>.
- Fichter, Christian. 2018. "Einführung." In *Wirtschaftspsychologie Für Bachelor*, edited by Christian Fichter, 1–26. Berlin, Heidelberg: Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-662-54944-5_1.
- Fischer, Ilan, Shacked Avrashi, Tomer Oz, Rabab Fadul, Koral Gutman, Daniel Rubenstein, Gregory Kroliczak, Sebastian Goerg, and Andreas Glöckner. 2020. "The Behavioural Challenge of the COVID-19 Pandemic: Indirect Measurements and Personalized Attitude Changing Treatments (IMPACT)." *Royal Society Open Science* 7 (8): 201131. <https://doi.org/10.1098/rsos.201131>.
- Fischer, Nancy, Elizabeth Moeller, and Jerry McNerny. 2023. "Unleashing the AI Imagination: A Global Overview of Generative AI Regulations." Pillsbury Winthrop Shaw Pittman LLP. <https://www.pillsburylaw.com/en/news-and-insights/ai-regulations-us-eu-uk-china.html>.
- Forbes. 2023. "10 Hurdles Companies Are Facing When Implementing AI." Forbes. 2023. <https://www.forbes.com/sites/theyec/2023/10/25/10-hurdles-companies-are-facing-when-implementing-ai-and-how-to-overcome-them/>.
- Frackiewicz, Marcin. 2023. "The Ethics of AI in Disaster Response and Management." *TS2 Space*, May. <https://ts2.space/en/the-ethics-of-ai-in-disaster-response-and-management/>.
- Garbuio, Massimo, and Nidhida Lin. 2021. "Innovative Idea Generation in Problem Finding: Abductive Reasoning, Cognitive Impediments, and the Promise of Artificial Intelligence." *Journal of Product Innovation Management* 38 (6): 701–25. <https://doi.org/10.1111/jpim.12602>.
- Garth. 2008. *Krisenmanagement und Kommunikation*. Wiesbaden: Gabler. <https://doi.org/10.1007/978-3-8349-9863-7>.
- Gensler, Gary, and Lily Bailey. 2020. "Deep Learning and Financial Stability." SSRN Scholarly Paper. Rochester, NY. <https://doi.org/10.2139/ssrn.3723132>.

- Gill, Karamjit S. 2016. "Artificial Super Intelligence: Beyond Rhetoric." *AI & SOCIETY* 31 (2): 137–43. <https://doi.org/10.1007/s00146-016-0651-x>.
- Gläser, J., and G. Laudes. 2006. *Experteninterviews Und Qualitative Inhaltsanalyse Als Instrument Rekonstruierender Untersuchung*. Vol. 2. Wiesbaden: Springer Fachmedien Wiesbaden.
- Glenn, Jerome. 2022. *Transition from Narrow to General Artificial Intelligence*. <https://www.youtube.com/watch?v=1h6hKqqmwn4>.
- Goertzel, Ben, and Cassio Pennachin, eds. 2019. *Artificial General Intelligence*. Cognitive Technologies. Berlin ; New York: Springer.
- Gruetzmacher, Ross, and Jess Whittlestone. 2022. "The Transformative Potential of Artificial Intelligence." *Futures* 135 (August). <https://www.sciencedirect.com/science/article/pii/S0016328721001932>.
- Gryn, Robter, and Pawel Rzeszucinski. 2018. "Bias in AI Is a Real Problem. Here's What We Should Do about It." World Economic Forum. <https://www.weforum.org/agenda/2018/09/the-biggest-risk-of-ai-youve-never-heard-of/>.
- Guillot, Jaume Duch. 2023. "Artificial Intelligence: Threats and Opportunities." European Parliament. https://www.europarl.europa.eu/news/en/headlines/society/20200918STO87404/artificial-intelligence-threats-and-opportunities?&at_campaign=20234-Digital&at_medium=Google_Ads&at_platform=Search&at_creation=RSA&at_goal=TR_G&at_audience=artificial%20intelligence&at_topic=Artificial_intelligence&at_location=DE&gclid=Cj0KCQjwpompBhDZARIsAFD_Fp_VtRLAIW8LwJ5REuhLEMB_aFkjiQhoKv7STnEYIhhwAmsfRGtJe2EaAk1PEALw_wcB.
- Gundel, Stephan. 2005. "Towards a New Typology of Crises." *Journal of Contingencies and Crisis Management* 13 (3): 106–15. <https://doi.org/10.1111/j.1468-5973.2005.00465.x>.
- Hall, Bryce, Michael Chui, Lareina Yee, Alex Singla, and Alexander Sukharevsky. 2023. "The State of AI in 2023: Generative AI's Breakout Year." McKinsey and Company. <https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai-in-2023-generative-ais-breakout-year>.
- Handbuch Krisen- und Restrukturierungsmanagement Generelle Konzepte, Spezialprobleme, Praxisberichte*. 2007. 1. Aufl. EBL-Schweitzer. Stuttgart Kohlhammer Verlag 2007.
- Harrison, Kim. 2020. "Causes of Organizational Crises Are so Predictable." Cutting Edge PR. June 1, 2020. <https://cuttingedgepr.com/articles/causes-of-organizational-crises-are-so-predictable/>.
- Helfferrich, C. 2011. *Die Qualität Qualitativer Daten: Manual Für Die Durchführung Qualitativer Interviews*. Vol. 4. Wiesbaden: VS Verlag für Sozialwissenschaften.
- Helm, J. Matthew, Andrew M. Swiergosz, Heather S. Haeberle, Jaret M. Karnuta, Jonathan L. Schaffer, Viktor E. Krebs, Andrew I. Spitzer, and Prem N. Ramkumar. 2020. "Machine Learning and Artificial Intelligence: Definitions, Applications, and Future Directions." *Current Reviews in Musculoskeletal Medicine* 13 (1): 69–76. <https://doi.org/10.1007/s12178-020-09600-8>.
- Heyden, Mariano L.M., Ralf Wilden, and Chelsea Wise. 2020. "Navigating Crisis from the Backseat? How Top Managers Can Support Radical Change Initiatives by Middle Managers." *Industrial Marketing Management* 88: 305–13. <https://doi.org/10.1016/j.indmarman.2020.05.024>.
- Hirschberg, Julia, and Christopher D. Manning. 2015. "Advances in Natural Language Processing." *Science* 349 (6245): 261–66. <https://doi.org/10.1126/science.aaa8685>.
- Hirt, Julian, and Thomas Nordhausen. 2019. "One size does not fit all – systematische Literaturrecherche in Fachdatenbanken - Schritt 10: Ergänzende Recherchemöglichkeiten." <https://doi.org/10.6094/KLINPFLEG.5.39>.

- Hsu, Chin-Chuan, Yuan Kao, Chien-Chin Hsu, Chia-Jung Chen, Shu-Lien Hsu, Tzu-Lan Liu, Hung-Jung Lin, Jhi-Joung Wang, Chung-Feng Liu, and Chien-Cheng Huang. 2023. "Using Artificial Intelligence to Predict Adverse Outcomes in Emergency Department Patients with Hyperglycemic Crises in Real Time." *BMC Endocrine Disorders* 23 (1): 234. <https://doi.org/10.1186/s12902-023-01437-9>.
- Janiesch, Christian, Patrick Zschech, and Kai Heinrich. 2021. "Machine Learning and Deep Learning." *Electronic Markets* 31 (3): 685–95. <https://doi.org/10.1007/s12525-021-00475-2>.
- Jaques, Tony. 2009. "Issue Management as a Post-crisis Discipline: Identifying and Responding to Issue Impacts beyond the Crisis." *Journal of Public Affairs* 9 (1): 35–44. <https://doi.org/10.1002/pa.310>.
- Johansson, Linus, and Lukas Pihl. 2023. "How and Why Organizations the Way They Do." Jönköping University.
- Joshi, Naveen. 2022. "Chasing The Myth: Why Achieving Artificial General Intelligence May Be A Pipe Dream." *Forbes*. 2022. <https://www.forbes.com/sites/naveenjoshi/2022/03/25/chasing-the-myth-why-achieving-artificial-general-intelligence-may-be-a-pipe-dream/>.
- Kaiser, Robert. 2014. *Qualitative Experteninterviews: Konzeptionelle Grundlagen Und Praktische Durchführung*. 2014th ed. Wiesbaden: Springer VS.
- Kaloudi, Nektaria, and Jingyue Li. 2021. "The AI-Based Cyber Threat Landscape: A Survey." *ACM Computing Surveys* 53 (1): 1–34. <https://doi.org/10.1145/3372823>.
- Kanbach, Dominik K., Louisa Heiduk, Georg Blueher, Maximilian Schreiter, and Alexander Lahmann. 2023. "The GenAI Is out of the Bottle: Generative Artificial Intelligence from a Business Model Innovation Perspective." *Review of Managerial Science*, September. <https://doi.org/10.1007/s11846-023-00696-z>.
- Kantaş, Hakan. 2023. "The Role of AI in Crisis Management and Business Continuity." An Opinion Piece by the Senior Director of IT, Continuity Management Department, at Halkbank, a Majority State-Owned Bank in Turkey. 2023. <https://aibusiness.com/verticals/building-resilient-organizations-the-role-of-ai-in-crisis-management-and-continuity#close-modal>.
- Kawaguchi, Kohei, Naomi Kodama, and Mari Tanaka. 2021. "Small Business under the COVID-19 Crisis: Expected Short- and Medium-Run Effects of Anti-Contagion and Economic Policies." *Journal of the Japanese and International Economies* 61: 101138. <https://doi.org/10.1016/j.jjie.2021.101138>.
- Kemper, H., and G. Kemper. 2020. "SENSOR FUSION, GIS AND AI TECHNOLOGIES FOR DISASTER MANAGEMENT." *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences* XLIII-B3-2020 (August): 1677–83. <https://doi.org/10.5194/isprs-archives-XLIII-B3-2020-1677-2020>.
- Kohn, Benedikt, and Fritz-Ulli Pieper. 2023. "AI Regulations around the World." TaylerWessing. <https://www.taylorwessing.com/en/interface/2023/ai---are-we-getting-the-balance-between-regulation-and-innovation-right/ai-regulation-around-the-world>.
- Kornai, András. 2014. "Bounding the Impact of AGI." *Journal of Experimental & Theoretical Artificial Intelligence* 26 (3): 417–38. <https://doi.org/10.1080/0952813X.2014.895109>.
- Krystek, Ulrich, and Mischa Lentz. 2013. "Unternehmenskrisen: Beschreibung, Ursachen, Verlauf und Wirkungen überlebenskritischer Prozesse in Unternehmen." In *Handbuch Krisenmanagement*, edited by Ansgar Thießen, 29–51. Wiesbaden: Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-531-19367-0_3.
- Kuusi, Osmo, and Sirkka Heinonen. 2022. "Scenarios From Artificial Narrow Intelligence to Artificial General Intelligence—Reviewing the Results of the International Work/Technology 2050 Study." *World Futures Review* 14 (1): 65–79. <https://doi.org/10.1177/19467567221101637>.

- Kuwertz, Achim, Maximilian Moll, Jennifer Sander, and Stefan Pickl. 2020. "A Systemic Approach for Early Warning in Crisis Prevention and Management." In *Human Systems Engineering and Design II*, edited by Tareq Ahram, Waldemar Karwowski, Stefan Pickl, and Redha Taiar, 1026:517–22. Cham: Springer International Publishing.
https://doi.org/10.1007/978-3-030-27928-8_78.
- Lagadec, Patrick. 2007. "Crisis Management in the Twenty-First Century: 'Unthinkable' Events in 'Inconceivable' Contexts." In *Handbook of Disaster Research*, by Havidán Rodríguez, Enrico L. Quarantelli, and Russell R. Dynes, 489–507. New York, NY: Springer New York.
https://doi.org/10.1007/978-0-387-32353-4_30.
- Lampel, Joseph, Jamal Shamsie, and Zur Shapira. 2009. "Experiencing the Improbable: Rare Events and Organizational Learning." *Organization Science* 20 (5): 835–45.
<https://doi.org/10.1287/orsc.1090.0479>.
- Laufer, Daniel, and W. Timothy Coombs. 2006. "How Should a Company Respond to a Product Harm Crisis? The Role of Corporate Reputation and Consumer-Based Cues." *Business Horizons* 49 (5): 379–85. <https://doi.org/10.1016/j.bushor.2006.01.002>.
- LeCun, Yann, Yoshua Bengio, and Geoffrey Hinton. 2015. "Deep Learning." *Nature* 521 (7553): 436–44. <https://doi.org/10.1038/nature14539>.
- Lee, So-Hyun, Sang-Hyeak Yoon, and Hee-Woong Kim. 2021. "Prediction of Online Video Advertising Inventory Based on TV Programs: A Deep Learning Approach." *IEEE Access* 9: 22516–27. <https://doi.org/10.1109/ACCESS.2021.3056115>.
- Li, Yang, and Otmar Hilliges, eds. 2021. *Artificial Intelligence for Human Computer Interaction: A Modern Approach*. Human-Computer Interaction Series. Cham: Springer.
- Linstone, Harold A. 1999. *Decision Making for Technology Executives: Using Multiple Perspectives to Improved Performance*. Artech House Technology Management and Professional Development Library. Boston: Artech House.
- Liu, Yipeng, Jong Min Lee, and Celia Lee. 2020. "The Challenges and Opportunities of a Global Health Crisis: The Management and Business Implications of COVID-19 from an Asian Perspective." *Asian Business & Management* 19 (3): 277–97.
<https://doi.org/10.1057/s41291-020-00119-x>.
- Lockwood, Nancy. n.d. *Crisis Management in Today's Business*. <https://www.shrm.org/hr-today/news/hr-magazine/documents/1205rquartpdf.pdf>.
- Mahesh, Batta. 2020. "Machine Learning Algorithms -A Review." https://www.researchgate.net/publication/344717762_Machine_Learning_Algorithms_-_A_Review.
- Manoj, Kamila, and Jasrotia Sahil. 2023. "Ethical Issues in the Development of Artificial Intelligence: Recognizing the Risks." *International Journal of Ethics and Systems*, July. <https://www.emerald.com/insight/content/doi/10.1108/IJOES-05-2023-0107/full/html>.
- Mansouri-Benssassi, Esma, Simon Rogers, Smarti Reel, Maeve Malone, Jim Smith, Felix Ritchie, and Emily Jefferson. 2023. "Disclosure Control of Machine Learning Models from Trusted Research Environments (TRE): New Challenges and Opportunities." *Heliyon* 9 (4): e15143. <https://doi.org/10.1016/j.heliyon.2023.e15143>.
- Marr, Bernard. 2023. "The 15 Biggest Risks Of Artificial Intelligence," June 2, 2023. <https://www.forbes.com/sites/bernardmarr/2023/06/02/the-15-biggest-risks-of-artificial-intelligence/>.
- Marsoof, Althaf, Andres Luco, Harry Tan, and Shafiq Joty. 2022. "Content-Filtering AI Systems—Limitations, Challenges and Regulatory Approaches," May. <https://www.tandfonline.com/doi/abs/10.1080/13600834.2022.2078395>.
- Maslej, Nestor. 2023. "Artificial Intelligence Index Report 2023." https://aiindex.stanford.edu/wp-content/uploads/2023/04/HAI_AI-Index-Report_2023.pdf.

- Mayring, P., and T. Frenzl. 2014. *Qualitative Inhaltsanalyse*. Wiesbaden: Wiesbaden Springer VS.
- McConnell, Allan, and Lynn Drennan. 2006. "Mission Impossible? Planning and Preparing for Crisis1." *Journal of Contingencies and Crisis Management* 14 (2): 59–70. <https://doi.org/10.1111/j.1468-5973.2006.00482.x>.
- Metz, Cade. 2023. "What's the Future for A.I.?" *The New York Times*, March 31, 2023, sec. Technology. <https://www.nytimes.com/2023/03/31/technology/ai-chatbots-benefits-dangers.html>.
- Meuser, M., and U. Nagel. 1991. *ExpertInneninterviews - Vielfach Erprobt, Wenig Bedacht: Ein Beitrag Zur Qualitativen Methodendiskussion*. Wiesbaden: Springer Fachmedien Wiesbaden.
- Mey, G., and K. Mruck. 2011. "Qualitative Interviews." In *Qualitative Marktforschung in Theorie Und Praxis*, 259–83. Wiesbaden: Springer Fachmedien Wiesbaden GmbH.
- Mey, Günter, and Katja Mruck, eds. 2020. *Handbuch Qualitative Forschung in der Psychologie: Band 2: Designs und Verfahren*. Wiesbaden: Springer Fachmedien Wiesbaden. <https://doi.org/10.1007/978-3-658-26887-9>.
- Mitroff, Ian I., and Gus Anagnos. 2001. *Managing Crises before They Happen: What Every Executive and Manager Needs to Know about Crisis Management*. New York: American Management Association.
- Mokeeva, T. V. 2022. "Learning through Mistakes in Crisis Management as a Strategy of Low Losses in Conditions of Continuous Uncertainty." *Vestnik Universiteta*, no. 12 (February): 10–17. <https://doi.org/10.26425/1816-4277-2021-12-10-17>.
- Moradi, Pegah, and Karen Levy. 2020. "The Future of Work in the Age of AI: Displacement or Risk-Shifting?" In *The Oxford Handbook of Ethics of AI*, by Pegah Moradi and Karen Levy, edited by Markus D. Dubber, Frank Pasquale, and Sunit Das, 269–88. Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780190067397.013.17>.
- Morel, Gaël, and Christine Chauvin. 2016. "Crisis Management: What Are the Methodological Challenges for Ergonomics?" *Le Travail Humain* 79 (1): 71–96. <https://www.cairn-int.info/revue-le-travail-humain-2016-1-page-71.htm>.
- Mosavi, Amir, Pinar Ozturk, and Kwok-wing Chau. 2018. "Flood Prediction Using Machine Learning Models: Literature Review." *Water* 10 (11): 1536. <https://doi.org/10.3390/w10111536>.
- Nadeem, Ayesha, Babak Abedin, and Olivera Marjanovic. 2020. "Gender Bias in AI: A Review of Contributing Factors and Mitigating Strategies." *ACIS 2020 Proceedings*, January. <https://aisel.aisnet.org/acis2020/27>.
- Nadia Ibrahim Nife, and Mohammed Chtourou. 2023. "A Comprehensive Study of Deep Learning and Performance Comparison of Deep Neural Network Models (YOLO, RetinaNet)." *International Journal of Online and Biomedical Engineering (IJOE)* 19 (12): 62–77. <https://doi.org/10.3991/ijoe.v19i12.42607>.
- Naidoo, Jeffrey, and Ronald E. Dulek. 2022. "Artificial Intelligence in Business Communication: A Snapshot." *International Journal of Business Communication* 59 (1): 126–47. <https://doi.org/10.1177/2329488418819139>.
- Nandana, Tk. 2023. "The Advancements and Limitations of AI in Today's World." February 23, 2023. <https://www.linkedin.com/pulse/advancements-limitations-ai-todays-world-nandana-tk/>.
- NIST. 2023. "NIST AI RMF Playbook." National Institute of Standards and technology. https://airc.nist.gov/AI_RM_F_Knowledge_Base/Playbook.
- Nolan, Beatrice. 2023. "Klarna Is Freezing Hiring and Turning to AI Tools Such as ChatGPT to Pick up the Slack." Business Insider. 2023. <https://www.businessinsider.com/klarna-freezes-hiring-shrink-the-company-relies-on-ai-chatgpt-2023-12>.

- Olechowski, Alison L., Steven D. Eppinger, Nitin Joglekar, and Katharina Tomaschek. 2020. "Technology Readiness Levels: Shortcomings and Improvement Opportunities." *Systems Engineering* 23 (4): 395–408. <https://doi.org/10.1002/sys.21533>.
- Pauchant, T., and I. Mitroff. 1992. "Transforming the Crisis-Prone Organization: Preventing Individual, Organizational, and Environmental Tragedies Jossey-Bass, San Francisco, CA 1992, 227 Pages." *Systems Research* 9 (4): 71–72. <https://doi.org/10.1002/sres.3850090410>.
- Paulus, David, Gerdien De Vries, Marijn Janssen, and Bartel Van De Walle. 2022. "The Influence of Cognitive Bias on Crisis Decision-Making: Experimental Evidence on the Comparison of Bias Effects between Crisis Decision-Maker Groups." *International Journal of Disaster Risk Reduction* 82: 103379. <https://doi.org/10.1016/j.ijdr.2022.103379>.
- Pearson, Christine M., and Judith A. Clair. 1998. "Reframing Crisis Management." *The Academy of Management Review* 23 (1): 59. <https://doi.org/10.2307/259099>.
- Pickel, Susanne, Gert Pickel, Hans-Joachim Lauth, and Detlef Jahn. 2008. *Methoden Der Vergleichenden Politik- Und Sozialwissenschaft: Neue Entwicklungen Und Anwendungen*. Wiesbaden: Springer-Verlag.
- Prunckun, Hank, ed. 2018. *Cyber Weaponry: Issues and Implications of Digital Arms*. 1st ed. 2018. Advanced Sciences and Technologies for Security Applications. Cham: Springer International Publishing : Imprint: Springer.
- Quarantelli, E. L., Arjen Boin, and Patrick Lagadec. 2018. "Studying Future Disasters and Crises: A Heuristic Approach." In *Handbook of Disaster Research*, edited by Havidán Rodríguez, William Donner, and Joseph E. Trainor, 61–83. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-63254-4_4.
- Quarantelli, Enrico L. 2001. "Another Selective Look at Future Social Crises: Some Aspects of Which We Can Already See in the Present." *Journal of Contingencies and Crisis Management* 9 (4): 233–37. <https://doi.org/10.1111/1468-5973.00173>.
- RAI. 2023. "RAI Institute Framework Dimensions." October 16, 2023. <https://www.responsible.ai/post/rai-institute-framework-dimensions-are-now-aligned-with-nist-ai-rmf-characteristics>.
- Raximov, Nodir, Oybek Primqulov, and Barno Daminova. 2021. "Basic Concepts and Stages of Research Development on Artificial Intelligence." In *2021 International Conference on Information Science and Communications Technologies (ICISCT)*, 1–4. Tashkent, Uzbekistan: IEEE. <https://doi.org/10.1109/ICISCT52966.2021.9670085>.
- Reeves, Martin, Annelies O'Dea, and Philipp Carlsson-Szlezak. 2022. "Make Resilience Your Company's Strategic Advantage." *Harvard Business Review*, March 25, 2022. <https://hbr.org/2022/03/make-resilience-your-companys-strategic-advantage>.
- Rizzo, A, J Williams, B John, B Newman, T Koenig, S Lange, and G Buckwalter. 2012. "Stress Resilience in Virtual Environments: Training Combat Relevant Emotional Coping Skills Using Virtual Reality." In . Reading: ICDVRAT.
- Rosenthal, Uriel, and Alexander Kouzmin. 1993. "Globalizing an Agenda for Contingencies and Crisis Management: An Editorial Statement." *Journal of Contingencies and Crisis Management* 1 (1): 1–12. <https://doi.org/10.1111/j.1468-5973.1993.tb00001.x>.
- Sakurai, Mihoko, and Yuko Murayama. 2019. "Information Technologies and Disaster Management – Benefits and Issues -." *Progress in Disaster Science* 2: 100012. <https://doi.org/10.1016/j.pdisas.2019.100012>.
- Samek, Wojciech, Gregoire Montavon, Sebastian Lapuschkin, Christopher J. Anders, and Klaus-Robert Muller. 2021. "Explaining Deep Neural Networks and Beyond: A Review of Methods and Applications." *Proceedings of the IEEE* 109 (3): 247–78. <https://doi.org/10.1109/JPROC.2021.3060483>.
- Scarpetta, Stefano, and Mark Pearson. 2022. "Policy Brief on the Future of Work - What Happened to Jobs at High Risk of Automation." Organisation for Economic Co-operation and

- Development. <https://www.oecd.org/future-of-work/reports-and-data/what-happened-to-jobs-at-high-risk-of-automation-2021.pdf>.
- Sharma, Gagan Deep, Sascha Kraus, Mrinalini Srivastava, Ritika Chopra, and Andreas Kallmuenzer. 2022. "The Changing Role of Innovation for Crisis Management in Times of COVID-19: An Integrative Literature Review." *Journal of Innovation & Knowledge* 7 (4): 100281. <https://doi.org/10.1016/j.jik.2022.100281>.
- Sharma, Mridul, and Mandeep Kaur. 2022. "A Review of Deepfake Technology: An Emerging AI Threat." In *Soft Computing for Security Applications*, edited by G. Ranganathan, Xavier Fernando, Fuqian Shi, and Youssouf El Alloui, 605–19. Advances in Intelligent Systems and Computing. Singapore: Springer. https://doi.org/10.1007/978-981-16-5301-8_44.
- Siedschlag, Alexander. 2010. "Jahrbuch für europäische Sicherheitspolitik 2009/2010." In . Nomos Verlagsgesellschaft mbH & Co. KG. <https://doi.org/10.5771/9783845221816>.
- Silberg, Jake, and James Manyika. 2019. "Tackling Bias in Artificial Intelligence (and in Humans)." <https://www.mckinsey.com/featured-insights/artificial-intelligence/tackling-bias-in-artificial-intelligence-and-in-humans>.
- Spagnoli, Paola, Amelia Manuti, Carmela Buono, and Chiara Ghislieri. 2021. "The Good, the Bad and the Blend: The Strategic Role of the 'Middle Leadership' in Work-Family/Life Dynamics during Remote Working." *Behavioral Sciences* 11 (8): 112. <https://doi.org/10.3390/bs11080112>.
- Sun, Jiao, Q. Vera Liao, Michael Muller, Mayank Agarwal, Stephanie Houde, Kartik Talamadupula, and Justin D. Weisz. 2022. "Investigating Explainability of Generative AI for Code through Scenario-Based Design." In *27th International Conference on Intelligent User Interfaces*, 212–28. Helsinki Finland: ACM. <https://doi.org/10.1145/3490099.3511119>.
- Sun, Wenjuan, Paolo Bocchini, and Brian D. Davison. 2020. "Applications of Artificial Intelligence for Disaster Management." *Natural Hazards* 103 (3): 2631–89. <https://doi.org/10.1007/s11069-020-04124-3>.
- Surianarayanan, Chellammal, and Pethuru Raj Chelliah. 2021. "Leveraging Artificial Intelligence (AI) Capabilities for COVID-19 Containment." *New Generation Computing* 39 (3–4): 717–41. <https://doi.org/10.1007/s00354-021-00128-0>.
- Taleb, Nassim Nicholas. 2004. "Opinion | Learning to Expect the Unexpected." *The New York Times*, April 8, 2004, sec. Opinion. <https://www.nytimes.com/2004/04/08/opinion/learning-to-expect-the-unexpected.html>.
- . 2007. *The Black Swan: The Impact of the Highly Improbable*. London: Allen Lane.
- Taurins, Elle. 2023. "The Impact of AI on Strategic Thinking and Decision-Making." Australian Institute of Management (AIM). 2023. <https://www.aimbusinessschool.edu.au/why-abs/research/the-impact-of-ai-on-strategic-thinking-and-decision-making>.
- Thießen, Ansgar. 2011. *Organisationskommunikation in Krisen*. Wiesbaden: VS Verlag für Sozialwissenschaften. <https://doi.org/10.1007/978-3-531-93372-6>.
- Townson, Sian. 2021. "3 Areas Where AI Will Boost Your Competitive Advantage." Harvard Business Review. <https://hbr.org/2021/12/3-areas-where-ai-will-boost-your-competitive-advantage>.
- Tranfield, David, David Denyer, and Palminder Smart. 2003. "Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review." *British Journal of Management* 14 (3): 207–22. <https://doi.org/10.1111/1467-8551.00375>.
- Turing, Alan, Achim Stephan, and Sven Walter. 2021. *Computing Machinery and Intelligence: Englisch/Deutsch = Können Maschinen Denken?* [Nachdruck] 2022. Reclams Universal-Bibliothek Great Papers Philosophie, Nr. 19647. Ditzingen: Reclam.

- Tzachor, Asaf, Jess Whittlestone, Lalitha Sundaram, and Seán Ó hÉigeartaigh. 2020. "Artificial Intelligence in a Crisis Needs Ethics with Urgency." *Nature Machine Intelligence* 2 (7): 365–66. <https://doi.org/10.1038/s42256-020-0195-0>.
- U, Yulin, Xiangtao Meng, and Anqi Li. 2023. "AI's Ethical Implications: Job Displacement." *Advances in Computer and Communication* 4 (3): 138–42. <https://doi.org/10.26855/acc.2023.06.006>.
- University of London. 2023. "Simple Search | The Online Library." 2023. <https://onlinelibrary.london.ac.uk/support/information-skills/finding-information-internet/simple-search>.
- Vajda, Christian, and Franziska Matzer. 2017. "Den Umgang mit psychosozialen Krisen im Medizinstudium und späteren Beruf erlernen: Vorstellung eines Lehrkonzepts." *Prävention und Gesundheitsförderung* 12 (4): 280–84. <https://doi.org/10.1007/s11553-017-0619-9>.
- Vohra, Sanjeev, Ajay Vasal, and Philippe Roussiere. 2023. "Der KI-Reifegrad – Vom Ersten Schritt Bis Zum Wettbewerbsvorteil." Accenture. https://www.accenture.com/de-de/insights/artificial-intelligence/ai-maturity-and-transformation?c=acn_glb_aimaturityfrompgooogle_13762124&n=psgs_0623&gclid=Cj0KCQjwhfipBhCqARIsAH9msblXL__EXPkj9nnFumo8fKS3hNMBpmFjQH_nD6mEi5wfiYWR5SvO-80aAvTGEALw_wcB&gclsrc=aw.ds.
- Wang, Harry Jiannan. 2023. "Introduction to GenAI: A Hands-on Teaching Workshop." *Rising like a Phoenix: Emerging from the Pandemic and Reshaping Human Endeavors with Digital Technologies ICIS 2023*, December. <https://aisel.aisnet.org/icis2023/pdw/pdw/3>.
- Wang, Pei. 2019. "On Defining Artificial Intelligence." *Journal of Artificial General Intelligence* 10 (2): 1–37. <https://doi.org/10.2478/jagi-2019-0002>.
- Wegge, Jürgen. 2015. "Leading in Times of Crisis: Examining the Effectiveness of Different Leadership Styles across Stages of the Crisis Lifecycle." TU Dresden.
- Weiner, Bernard. 1985. "An Attributional Theory of Achievement Motivation and Emotion." *Psychological Review* 92 (4): 548–73. <https://doi.org/10.1037/0033-295X.92.4.548>.
- . 1995. *Judgments of Responsibility: A Foundation for a Theory of Social Conduct*. Judgments of Responsibility: A Foundation for a Theory of Social Conduct. New York, NY, US: Guilford Press.
- Wut, Tai Ming, Jing (Bill) Xu, and Shun-mun Wong. 2021. "Crisis Management Research (1985–2020) in the Hospitality and Tourism Industry: A Review and Research Agenda." *Tourism Management* 85: 104307. <https://doi.org/10.1016/j.tourman.2021.104307>.
- "AI Watch Index." 2022. European Commission. https://ai-watch.ec.europa.eu/news/ai-watch-index-2022-03-28_en.
- "Building Organizational Resilience | McKinsey." 2023. 2023. <https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/raising-the-resilience-of-your-organization>.
- "Commission Welcomes Political Agreement on Artificial Intelligence Act." n.d. Text. European Commission - European Commission. Accessed December 15, 2023. <https://ec.europa.eu/commission/presscorner/home/en>.
- "Emerging AI Risks Underscore Urgent Need for Responsible AI." 2023. Boston: Boston Consulting Group. <https://www.bcg.com/press/20june2023-emerging-ai-risks-need-for-responsible-ai>.
- "Generative AI Deepfake Triggers a National Security Crisis." 2023. December 5, 2023. <https://www.home.saxo/content/articles/outrageous-predictions/generative-ai-deepfake-triggers-a-national-security-crisis-05122023>.

- “How Artificial Intelligence Is Transforming the World.” n.d. Brookings. Accessed December 18, 2023. <https://www.brookings.edu/articles/how-artificial-intelligence-is-transforming-the-world/>.
- “NATIONAL ARTIFICIAL INTELLIGENCE AND DEVELOPMENT PLAN.” 2023. <https://www.whitehouse.gov/wp-content/uploads/2023/05/National-Artificial-Intelligence-Research-and-Development-Strategic-Plan-2023-Update.pdf>.
- “Strategic Responses to Crisis.” 2021. *Strategic Management Journal* 42 (2). <https://doi.org/10.1002/smj.3161>.
- “The Resilience Revolution: PwC’s Global Crisis and Resilience Survey 2023.” 2023. PwC. 2023. <https://www.pwc.com/gx/en/issues/crisis-solutions/global-crisis-survey.html>.
- “Winning the War for Talent in the Age of AI & Data.” 2023. Deloitte United Kingdom. 2023. <https://www2.deloitte.com/uk/en/blog/experience-analytics/2023/winning-the-war-for-talent-in-the-age-of-ai-and-data.html>.

Sources: Decision-Making by Sinah Janssen

- Al-Dabbagh, Zeyad S. 2020. "The Role of Decision-Maker in Crisis Management: A Qualitative Study Using Grounded Theory (COVID-19 Pandemic Crisis as A Model)." *Journal of Public Affairs*, July. <https://doi.org/10.1002/pa.2186>.
- Ali, Rahman, Anwar Hussain, Shah Nazir, Sulaiman Khan, and Habib Ullah Khan. 2023. "Intelligent Decision Support Systems—An Analysis of Machine Learning and Multicriteria Decision-Making Methods." *Applied Sciences* 13 (22): 12426. <https://doi.org/10.3390/app132212426>.
- Araujo, Theo, Natali Helberger, Sanne Kruikemeier, and Claes H. De Vreese. 2020. "In AI We Trust? Perceptions about Automated Decision-Making by Artificial Intelligence." *AI & SOCIETY* 35 (3): 611–23. <https://doi.org/10.1007/s00146-019-00931-w>.
- Bag, Surajit, Shivam Gupta, Ajay Kumar, and Uthayasankar Sivarajah. 2021. "An Integrated Artificial Intelligence Framework for Knowledge Creation and B2B Marketing Rational Decision Making for Improving Firm Performance." *Industrial Marketing Management* 92: 178–89. <https://doi.org/10.1016/j.indmarman.2020.12.001>.
- Behnke, Nathalie, and Steffen Eckhard. 2022. "A Systemic Perspective on Crisis Management and Resilience in Germany." *Dms – Der Moderne Staat – Zeitschrift Für Public Policy, Recht Und Management* 15 (1–2022): 3–19. <https://doi.org/10.3224/dms.v15i1.11>.
- Bhushan, Navneet, and Kanwal Rai. 2004. "Strategic Decision-Making." In *Strategic Decision Making*, by Navneet Bhushan and Kanwal Rai, 3–10. London: Springer London. https://doi.org/10.1007/978-1-85233-864-0_1.
- Boin, Arjen, Paul 'T Hart, Eric Stern, and Bengt Sundelius. 2016. *The Politics of Crisis Management: Public Leadership under Pressure*. 2nd ed. Cambridge University Press. <https://doi.org/10.1017/9781316339756>.
- Bonabeau, Eric. 2003. "Don't Trust Your Gut." *Harvard Business Review*, May 1, 2003. <https://hbr.org/2003/05/dont-trust-your-gut>.
- Brehmer, Berndt. 1992. "Dynamic Decision Making: Human Control of Complex Systems." *Acta Psychologica* 81 (3): 211–41. [https://doi.org/10.1016/0001-6918\(92\)90019-A](https://doi.org/10.1016/0001-6918(92)90019-A).
- Bryan, Lowell. 2009. "Dynamic Management: Better Decisions in Uncertain Times." *McKinsey Quarterly*. https://truenorthadvisers.com/wp-content/uploads/2017/06/Dynamic_Management.pdf.
- Burnett, John J. 1998. "A Strategic Approach to Managing Crises." *Public Relations Review* 24 (4): 475–88. [https://doi.org/10.1016/S0363-8111\(99\)80112-X](https://doi.org/10.1016/S0363-8111(99)80112-X).
- Buzna, Lubos, Karsten Peters, Hendrik Ammoser, Christian Kühnert, and Dirk Helbing. 2007. "Efficient Response to Cascading Disaster Spreading." *Physical Review E* 75 (5): 056107. <https://doi.org/10.1103/PhysRevE.75.056107>.
- Chermack, Thomas J. 2004. "Improving Decision-Making with Scenario Planning." *Futures* 36 (3): 295–309. [https://doi.org/10.1016/S0016-3287\(03\)00156-3](https://doi.org/10.1016/S0016-3287(03)00156-3).
- Chermack, Thomas J., and Susan A. Lynham. 2002. "Definitions and Outcome Variables of Scenario Planning." *Human Resource Development Review* 1 (3): 366–83. <https://doi.org/10.1177/1534484302013006>.
- Coles, Susan, and Jennifer Rowley. 1995. "Revisiting Decision Trees." *Management Decision* 33 (8): 46–50. <https://doi.org/10.1108/00251749510093932>.
- "Decision Making AI versus Humans." 2023. Data & Analytics. 2023. <https://www.linkedin.com/pulse/decision-making-ai-versus-humans-data-and-analytics-magazin>.
- Durfee, Adam. 2019. "Council Post: Why Chatbots Should Be Part Of Your Crisis Communications Plan." Forbes. 2019. <https://www.forbes.com/sites/forbescommunicationscouncil/2019/10/17/why-chatbots-should-be-part-of-your-crisis-communications-plan/>.

- Elbanna, Said, and John Child. 2007. "Influences on Strategic Decision Effectiveness: Development and Test of an Integrative Model." *Strategic Management Journal* 28 (4): 431–53. <https://doi.org/10.1002/smj.597>.
- Enarsson, Therese, Lena Enqvist, and Markus Naartijärvi. 2022. "Approaching the Human in the Loop – Legal Perspectives on Hybrid Human/Algorithmic Decision-Making in Three Contexts." *Information & Communications Technology Law* 31 (1): 123–53. <https://doi.org/10.1080/13600834.2021.1958860>.
- Finkenzstadt, Daniel J., Tojin T. Eapen, Jake Sotiriadis, and Peter Guinto. 2023. "Use GenAI to Improve Scenario Planning." *Harvard Business Review*, November 30, 2023. <https://hbr.org/2023/11/use-genai-to-improve-scenario-planning>.
- Franzen, Carl. 2023. "Consulting Giant McKinsey Unveils Its Own Generative AI Tool for Employees: Lilli." *VentureBeat* (blog). August 16, 2023. <https://venturebeat.com/ai/consulting-giant-mckinsey-unveils-its-own-generative-ai-tool-for-employees-lilli/>.
- Gasaway, Richard B. 2023. "How Smart Health Leaders Make Intuitive Decisions." *Healthcare Management Forum*, November, 08404704231212781. <https://doi.org/10.1177/08404704231212781>.
- Goh, Moh Heng. 2021. "Making Decisions During A Crisis." 2021. <https://blog.bcm-institute.org/crisis-management/making-decision-during-a-crisis>.
- Gülen, Kerem. 2022. "Artificial Intelligence And Self-Driving Cars Explained." 2022. <https://dataconomy.com/2022/12/28/artificial-intelligence-and-self-driving/>.
- Gurkan, Necdet, and Bei Yan. 2023. "Early Chatbot Assistance Can Enhance Team Decision-Making by Promoting Cognitive Diversity and Information Elaboration." *AMCIS 2023 Proceedings*, August. https://aisel.aisnet.org/amcis2023/sig_core/sig_core/6.
- Hale, Joanne E., David P. Hale, and Ronald E. Dulek. 2006. "Decision Processes During Crisis Response: An Exploratory Investigation." *Journal of Managerial Issues* 18 (3): 301–20. <https://www.jstor.org/stable/40604542>.
- Haleem, Abid, Mohd Javaid, and Ravi Pratap Singh. 2022. "An Era of ChatGPT as a Significant Futuristic Support Tool: A Study on Features, Abilities, and Challenges." *BenchCouncil Transactions on Benchmarks, Standards and Evaluations* 2 (4): 100089. <https://doi.org/10.1016/j.tbench.2023.100089>.
- Harrison, E. Frank. 1996. "A Process Perspective on Strategic Decision Making." *Management Decision* 34 (1): 46–53. <https://doi.org/10.1108/00251749610106972>.
- Heracleous, Loizos Th. 1994. "Rational Decision Making: Myth or Reality?" *Management Development Review* 7 (4): 16–23. <https://doi.org/10.1108/09622519410771628>.
- Hodgkinson, Gerard P., and Ian Clarke. 2007. "Conceptual Note: Exploring the Cognitive Significance of Organizational Strategizing: A Dual-Process Framework and Research Agenda." *Human Relations* 60 (1): 243–55. <https://doi.org/10.1177/0018726707075297>.
- Jajčinović, Marko, and Marko Toth. 2018. "MODELS OF DECISION MAKING - ADVANTAGES AND DRAWBACKS IN CRISIS MANAGEMENT" 2. <https://hrcak.srce.hr/file/311055>.
- Jarrahi, Mohammad Hossein. 2018. "Artificial Intelligence and the Future of Work: Human-AI Symbiosis in Organizational Decision Making." *Business Horizons* 61 (4): 577–86. <https://doi.org/10.1016/j.bushor.2018.03.007>.
- Kazemi, Ali. 2023. "Futurium | European AI Alliance - AI for Crisis Management: Impacts, Challenges, Best Practices." 2023. <https://futurium.ec.europa.eu/en/european-ai-alliance/forum-discussion/ai-crisis-management-impacts-challenges-best-practices>.
- Khatri, Naresh, and H. Alvin Ng. 2000. "The Role of Intuition in Strategic Decision Making." *Human Relations* 53 (1): 57–86. <https://doi.org/10.1177/0018726700531004>.

- Klein, Gary A., and John Sullivan. 2001. "Sources of Power: How People Make Decisions." *Leadership and Management in Engineering* 1 (1): 21–21. [https://doi.org/10.1061/\(ASCE\)1532-6748\(2001\)1:1\(21\)](https://doi.org/10.1061/(ASCE)1532-6748(2001)1:1(21)).
- Korteling, J. E. (Hans), G. C. Van De Boer-Visschedijk, R. A. M. Blankendaal, R. C. Boonekamp, and A. R. Eikelboom. 2021. "Human- versus Artificial Intelligence." *Frontiers in Artificial Intelligence* 4 (March): 622364. <https://doi.org/10.3389/frai.2021.622364>.
- Lazaro, Gina. 2023. "Understanding Gender and Racial Bias in AI." ALI Social Impact Review. 2023. <https://www.sir.advancedleadership.harvard.edu/articles/understanding-gender-and-racial-bias-in-ai>.
- Malekolkalami, Mila, and Najme Nazeri. 2021. *Chatbots in Knowledge Transfer in Digital Organizations*. CDIS. https://www.researchgate.net/publication/350584039_Chatbots_in_Knowledge_Transfer_in_Digital_Organizations.
- Mar, Win, and Yin Myo Kay Khine Thaw. 2019. "An Analysis of Benefits and Risks of Artificial Intelligence" 3 (5). <https://doi.org/https://doi.org/10.31142/ijtsrd26667>.
- "Meet Lilli, Our Generative AI Tool." 2023. 2023. <https://www.mckinsey.com/about-us/new-at-mckinsey-blog/meet-lilli-our-generative-ai-tool>.
- Meyerowitz, Danielle, Charlene Lew, and Göran Svensson. 2018. "Scenario-Planning in Strategic Decision-Making: Requirements, Benefits and Inhibitors." *Foresight* 20 (6): 602–21. <https://doi.org/10.1108/FS-04-2018-0036>.
- Morecroft, John. 1983. "System Dynamics Portraying Bounded Rationality." <https://sdjournalclub.mit.edu/sites/default/files/documents/MORECROFT%20-%20System%20Dynamics%20-%20Portraying%20Bounded%20Rationality%20-%201982.pdf>.
- Mufti, Salman. 2013. *Managerial Decision Making*. https://smith.queensu.ca/insight/content/managerial_decision_making.php.
- Musliu, Rinor. 2023. "McKinsey's Lilli: A Glimpse into the AI-Powered Consulting Future." 2023. <https://www.linkedin.com/pulse/mckinseys-lilli-glimpse-ai-powered-consulting-future-rinor-musliu>.
- Nadeem, Ayesha, Olivera Marjanovic, and Babak Abedin. 2022. "Gender Bias in AI-Based Decision-Making Systems: A Systematic Literature Review." *Australasian Journal of Information Systems* 26 (December). <https://doi.org/10.3127/ajis.v26i0.3835>.
- Raguz, Ivona Vrdoljak. 2007. "Decision-Making Process in Crisis Situations." *Annals of DAAAM & Proceedings*, January, 815–17. <https://go.gale.com/ps/i.do?p=AONE&sw=w&issn=17269679&v=2.1&it=r&id=GALE%7CA177174871&sid=googleScholar&linkaccess=abs>.
- Rink, Floor, and Naomi Ellemers. 2010. "Benefiting from Deep-Level Diversity: How Congruence between Knowledge and Decision Rules Improves Team Decision Making and Team Perceptions." *Group Processes & Intergroup Relations* 13 (3): 345–59. <https://doi.org/10.1177/1368430209344866>.
- Sayegh, Lisa, William P. Anthony, and Pamela L. Perrewé. 2004. "Managerial Decision-Making under Crisis: The Role of Emotion in an Intuitive Decision Process." *Human Resource Management Review* 14 (2): 179–99. <https://doi.org/10.1016/j.hrmr.2004.05.002>.
- Senge, Peter M. 2006. *The Fifth Discipline: The Art and Practice of the Learning Organization*. Rev. and Updated. New York: Doubleday/Currency.
- Silberg, Jake, and James Manyika. 2019. "Notes from the AI Frontier: Tackling Bias in AI (and in Humans)." <https://www.mckinsey.com/~/media/mckinsey/featured%20insights/artificial%20intelligence/tackling%20bias%20in%20artificial%20intelligence%20and%20in%20humans/mgi-tackling-bias-in-ai-june-2019.pdf>.

- Snizek, Janet A., David C. Wilkins, Patrick L. Wadlington, and Michael R. Baumann. 2002. "Training for Crisis Decision-Making: Psychological Issues and Computer-Based Solutions." *Journal of Management Information Systems* 18 (4): 147–68. <https://www.jstor.org/stable/40398546>.
- T Hart, Paul, Uriel Rosenthal, and Alexander Kouzmin. 1993. "Crisis Decision Making: The Centralization Thesis Revisited." *Administration & Society* 25 (1): 12–45. <https://doi.org/10.1177/009539979302500102>.
- Valz, Duane. 2023. "Personalization: Why the Relational Modes Between Generative AI Chatbots and Human Users Are Critical Factors for Product Design and Safety." SSRN Scholarly Paper. Rochester, NY. <https://doi.org/10.2139/ssrn.4468899>.
- Virtual Conference: The State of AI in Risk Management*. 2023. https://us06web.zoom.us/rec/play/JD5fRgSLC3oW-90phJ6mQ1tWltbizluYxBrSjWdhGU1n08AS0ZBtoZT9mXjJMN81Ib0BoKnVni5x9VZG.MA7U4Gi4iqgibUYq?canPlayFromShare=true&from=share_recording_detail&continueMode=true&componentName=rec-play&originRequestUrl=https%3A%2F%2Fus06web.zoom.us%2Frec%2Fshare%2FwvUdQV7yLG_CZY9AWNWNc2UmTsIH5t2sbt6b3EtKBLAIKFvDEA4cuNHytqEs_o9.kNQ7F63xphZ6uhbd.
- Wilson, Ian. 2000. "From Scenario Thinking to Strategic Action." *Technological Forecasting and Social Change* 65 (1): 23–29. [https://doi.org/10.1016/S0040-1625\(99\)00122-5](https://doi.org/10.1016/S0040-1625(99)00122-5).
- Ziakkas, Dimitrios, Anastasios Plioutsias, and Konstantinos Pechlivanis. 2022. "Artificial Intelligence in Aviation Decision Making Process.The Transition from Extended Minimum Crew Operations to Single Pilot Operations (SiPO)." In . <https://doi.org/10.54941/ahfe1001452>.

VII Appendices

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Appendix 1: Systematic Literature Review

Appendix 1.1: Overview of Literature for Potentials in Early Detection and Preparation

Systematic Literature Review - Google Scholar Search

Real-Time	Artificial Intelligence	AI	Crisis	Cyber	Scenario	Prediction	Early Warning	Detection	Digital Transformation	Chatbot	# results	relevant	Abstract of relevant paper scanned	Papers used in Thesis after scanning Abstract
▲ X ○	▲ X ○		▲ X ○	X				X		▲ X ○	376	N/A	7	2
	▲ X ○		▲ X ○		X						8	3	3	1
		▲ X			▲ X ○	X					117	N/A	9	2
			▲ X						▲ X ○		61	42	6	1
▲ X ○						▲ X		▲ X			/	/	/	0
	▲ X			X			▲ X ○				4,440,000	N/A	9	1
								▲ X			1,040	N/A	8	2

X Search term was used
▲ Search term must be part of article
○ Search term must be part of title
n/a as number of search results too high

Simple Keyword Search - Google Search Engine

Frequently used words (in conjunction) in search queries

AI	Cyber Attack	Crisis	Techniques	Early Warning Sys.	Trigger	Pattern	Chatbots	Early Detection	Prediction	Warning
X							X	X		
X		X						X		
X			X	X					X	X
	X				X					
				X		X				
							X	X		
		X								X
		X								

*Further articles identified by forward and backward search

In total 11 articles were used for Analysis (cf. Chapter 7.1.2)

Appendix 1.2: Overview of Literature for Potentials in Decision Making

Systematic Literature Review - Google Scholar Search													
Decision-Making	Crisis	Management	AI	Artificial Intelligence	Chatbots	Organizations	Scenario Planning	automated	GenAI	# results	relevant	Abstract of relevant paper scanned	Papers used in Thesis after scanning Abstract
▲ X ○	X		X	▲ X ○				X		411000	n/a	18	1
X			X	▲ X ○						117	10	10	2
X						X	▲ X ○			21	n/a	12	1
X							▲ X ○			270	0	/	/
X			X		X				X	464	n/a	10	1
▲ X	X	X	X							594	n/a	4	0
X	X			▲ X ○						201	5	5	0
X	X	X	X						X	7280	n/a	/	/
X: Search term was used ▲: Search term must be part of article ○: Search term must be part of title n/a as number of search results too high													
Simple Keyword Search - Google Search Engine													
Frequently used words (in conjunction) in search queries													
Decisions	Making	Crisis	Management	AI	Artificial Intelligence	Chatbots	Tools						
X	X	X	X	X	X	X	X						
*Further articles identified by forward and backward search In total 14 articles were used for Analysis (cf. Chapter 7.2.2)													

Appendix 1.3: Overview of Literature for Potentials in Strategy Implementation and Control

Systematic Literature Review - Google Scholar Search

Crisis Management	Crisis	Artificial Intelligence	AI	Communication	Coordination	Control	Team	KPI	Performance	# results	relevant	Abstract of relevant paper scanned	Papers used in Thesis after scanning Abstr.
▲ X ○	X		▲ X ○	▲ X						31	12	7	1
	▲ X		▲ X	▲ X						1,230,000	N/A	24	2
		▲ X ○			X	X				1,490,000	N/A	22	2
			▲ X ○					▲ X		77,500	N/A	12	1
▲ X			▲ X ○					X	▲ X ○	803	N/A	10	2
▲ X ○						▲ X ○			X	209	112	17	1
			▲ X ○	X	X	X				120,000	N/A	14	1
						X	▲ X			2,570,000	N/A	16	1

X: Search term was used
 ▲: Search term must be part of article
 ○: Search term must be part of title
 n/a as number of search results too high

Simple Keyword Search - Google Search Engine

Frequently used words (in conjunction) in search queries										
Crisis	AI	Communication	Coordination	Control	KPI	Skills	Team	AGI	GenAI	Tools
X									X	
	X	X								X
	X		X							X
X	X			X			X			
			X		X					
X				X		X	X			
X					X	X		X		X
X		X							X	
X										X

*Further articles identified by forward and backward search

In total 11 articles were used for Analysis (cf. Chapter 7.3.2)

Appendix 1.4: Overview of Literature for Potentials in Organizational Learning

Systematic Literature Review - Google Scholar Search

[illegible]

- ✕ Search term was used
- ▲ Search term must be part of article
- Search term must be part of title

n/a as number of search results too high

Simple Keyword Search - Google Search Engine

[illegible]

*Further articles identified by forward and backward search

In total **11 articles** were used für Analysis (cf. Chapter 7.4.2)

Appendix 2: Semi-structured Guide for Expert Interviews

Questionnaire for the expert interview

About the master thesis "*Artificial intelligence in crisis management - an analysis of potentials and limitations to enhance top management responses as part of business resilience.*"

Name:

Company:

Position:

Phone number:

Email address:

Interviewer:

Date:

Interview Objective:

This survey aims to facilitate dialogue among crisis management, AI experts, and Nova SBE students. In doing so, an exchange of information will take place that targets the topic of "Artificial intelligence in crisis management."

Introductory questions:

The "Introductory Questions" question block is intended to understand the interview partner's professional background. The subsequent analysis process aims to determine if professional backgrounds provide insight into determining critical potentials and limits.

1. Please introduce your role and the company you represent and highlight your touch points in artificial intelligence or crisis management.
2. Considering your work environment, company size, and industry – how would you rate the technology readiness level¹ and adaption of relevant stakeholders/clients?

Scoping / Contracting Question:

The scoping or contracting questions clarify the starting point for analyzing potentials and limitations in crisis management and artificial intelligence interaction. To derive general conclusions, we kindly ask you to answer **each** of these **questions** based on experience - if applicable - **for the process phases** "early detection and preparation," "strategic decision making," "performance management and control," and "organizational learning."

1. What limitations or challenges do you anticipate in crisis management processes, particularly regarding information handling, time delays, and cost factors?
2. What tools or technologies do you use to prevent, handle, and learn from different crises in your organization?
3. Can you share any examples of real-world problems you have encountered while using AI or other implications in crisis management and how you addressed them?
4. What advantages and risks are these AI implications offering in crisis management?
5. What are the critical skills and resources required for organizations to succeed in crisis management and integrate AI into their crisis management processes effectively?
6. What are the essential human requirements and leadership skills necessary to complement implementing an effective AI tool? Additionally, what other skill gaps does AI technology exhibit?
7. What steps do organizations need to take to prepare top management for the effective integration of AI into crisis management?
8. What data privacy concerns and implications have you encountered in the context of AI applications (in crisis management)? What are potential solutions or best practices for addressing these issues?

Reflective Questions:

This question deals with future trends within crisis management. The aim is to determine whether artificial intelligence's importance is also increasing in this area and its influence on top management and the respective specialist departments.

1. How do you envision the evolution of AI's role in crisis management and the resulting implications for organizations and society in the foreseeable future?
2. In your opinion, to what extent can AI replace human beings in crisis management? (i.e., in conventional crises such as ill-structured systems or during natural catastrophes)
3. Is there any additional information, best practices, or critical insights you would like to share regarding integrating AI in crisis management?

Thank you for participating in the interview and the resulting project support!

Non-disclosure agreement signed.

Description of interview situation:

Location:

Interview recording: Microsoft Teams conference recording was used to secure the data. Thanks to a quiet environment, high-quality audio files could be generated here. These can be accessed via the following link:

Short description of the atmosphere

Duration of Interview:

¹ **Scoring Technology readiness level:** 1 = basic principles observed; 2 = technology concept formulated; 3 = experimental proof of concept; 4 = technology validated in lab; 5 = technology validated in relevant environment; 6 = technology demonstrated in relevant environment; 7 = system prototype demonstrated in operational environment; 8 = system complete and qualified; 9 = actual system proven in operational environment

Appendix 3: Overview Quantitative Content Analysis of Expert Interviews

Appendix 3.1: Selection of Experts

Selection of Interviewpartner (Experts)						
Matching	Date	Duration in min	Professional Background	Company/Orga overview (key KPIs: revenue, # employees, technology readiness score)	Location	Position
Expert 1	30.10.2023	48	Academia/Industry	Industry: Software Revenue: 220.6 USD Academia Employees: 1000 TRL: 9	Austria	Academia: MBA Director Compliance & Risk Management Industry: Head of Group Risk and Control
Expert 2	07/11/2023	49	Academia/Consulting	University / Coaching Revenue: N/A Employees: 20 TRL: 7	UK	Executive Director
Expert 3	07/11/2023	43	Academia	University / Government Revenue: N/A Employees: 2.000 TRL: 6	Australia	Professor of Law, Co-Director of the Centre for AI and Digital Ethics
Expert 4	06/11/2023	37	Academia/Consulting	Industry: Consulting Revenue: USD 50.3 mn Employees: 14.000 Employee clients: 500-50.000 TRL: 5 TLR clients: 2-7	Portugal	Director and Lecturer
Expert 5	31/10/2023	34	Industry	Industry: Insurance Revenue: USD 21 mn HQ: London, UK Employees: 76.000 TRL: 8	UK	Senior Consultant - Crisis & Resilience
Expert 6	31.10.2023	48	Consulting	Industry: Consulting Revenue: N/A Employees: 40 Employee clients: 100-25.000 TRL: 7 TRI clients: 1-3	Israel	Managing Partner
Expert 7	10/11/2023	37	Consulting	Industry: Consulting Revenue: N/A Employees: 20 Employee clients: 100-50.000 TRL: 6 TRI clients: 3-8	US	Principal & CEO, Crisis Management & Business Continuity Expert
Expert 8	10/11/2023	43	Consulting	Industry: Consulting Revenue: USD 275 mn Employees: 800 Employee clients: 1.000-150.000 TRL: 6 TRI clients: 3-8	Germany	Senior Consultant – Quality and Risk Management
Expert 14	20/11/2023	58	Industry	Industry: Banking Revenue: USD 45.7bn HQ: NYC, NY, USA Employees: 48.500 TRL: 8	Germany	Senior Manager - Cyber and Strategic Risk
Expert 9	06/11/2023		Industry	Industry: Banking & Insurance Revenue: USD 51 bn Employees: 184.000 TRL: 7	Germany	Vice President - Operational Risk
Expert 10	14/11/2023	44	Industry	Industry: Consumer Goods Revenue: USD 9 bn Employees: 21.000 TRL: 6-7	Portugal	Crisis Management Risk Officer
Expert 11	In Progress	25	Industry	Industry: Coaching Revenue: N/A Employees: 20 Clients: 100-2.500 TRL: 8	Germany	Global Director Crisis Consumer & Excellence
Expert 12	08/11/2023	24	Industry	Industry: Retail Revenue: USD 160 bn Employees: 575.000 TRL: 8	Germany	Founder - IT Security
Expert 13	07/11/2023	43	Consulting	Industry: Consulting Revenue: USD 2.5 bn Employees: 12.500 TRL: 7	Germany	Professional Crisis- Emergency - and Business Continuity Manger
Expert 15	09/11/2023	43	NGO / Crisis Expert	Industry: NGO Revenue: USD 1 bn Employees: 7.000 TRL: 8	Germany	Civil Protection OrgL and ÖEL, BRC Head of Operations, EU Civil Protection Mechanism Lead, Project Lead Crisis Management with AI Technologies
Expert 16	06/11/2023	46	NGO / Crisis Expert	Industry: NGO Revenue: USD 14.1bn Employees: 25.700 TRL NGO: 7 TRL clients: 2-5	UK	Disaster Risk & Crisis Management Specialist

Appendix 3.2: Creation of Categories based on Expert Interview Guide

Categories	Interview guide
Classification of the company / profession	Please introduce your role and the company you represent and highlight your touch points in artificial intelligence or crisis management.
Understanding & status quo AI & CM	Considering your work environment, company size, and industry – how would you rate the technology readiness level and adaption of relevant stakeholders/clients?
	What tools or technologies do you use to prevent, handle, and learn from different crises in your organization?
	Can you share any examples of real-world problems you have encountered while using AI or other implications in crisis management and how you addressed them?
Needed requirements, potentials and limitations of AI in CM context	What advantages are these AI implications offering in crisis management?
	What limitations or challenges do you anticipate in crisis management processes, particularly regarding information handling, time delays, and cost factors?
	What are the critical skills and resources required for organizations to succeed in crisis management and integrate AI into their crisis management processes effectively?
	What are the essential human requirements and leadership skills necessary to complement implementing an effective AI tool? Additionally, what other skill gaps does AI technology exhibit?
	What steps do organizations need to take to prepare top management for the effective integration of AI into crisis management?
Future outlook / forecast of applicability of AI in CM (per industry)	What data privacy concerns and implications have you encountered in the context of AI applications (in crisis management)? What are potential solutions or best practices for addressing these issues?
	How do you envision the evolution of AI's role in crisis management and the resulting implications for organizations and society in the foreseeable future?
	In your opinion, to what extent can AI replace human beings in crisis management? (i.e., in conventional crises such as ill-structured systems or during natural catastrophes)
	Categories provide rough classification, but due to the open-ended nature of the guided interview, no direct clustering of questions and category

Appendix 3.3: Exemplary Evaluation of Transcripts (detailed)

Number Interviewpartner	Profession background	Position	Date	Classification of the company / profession	Understanding & status quo AI & CM	General requirements, potentials and limitations
Expert 1	Academia/Industry	Academia: MBA Director Compliance & Risk Management Industry: Head of Group Risk and Control	30.10.2023	Industry: Software Revenue: 220.6 USD Academic Employees: 1000 TBL: 9	I am now more focused on AI due to the hype, but I have been constantly involved in process-related machine learning and algorithms in compliance, fraud, and accounting for a long time. Therefore, I am pretty used to these scenarios. Currently, I work for camera manufacturer's software department, and I teach multiple MBA classes. -chessing phases identical to our framework: prediction and preparation, decision-making, strategic control and measurement, and organizational learning -Use Case: identification of a fall in a hospital and then notifying clinical staff via an alarm on the phone	General info: - we train from actual or simulated footage; - Another example to show risk management's relevance is the Black-Scholes Model algorithm. The two mathematicians create a formula to pin underlying asset or overvalued. However, there was a crisis in Asia in '98. In five days, they almost lost everything because the algorithm assumes conditions. They disconnected the servers before they had more debt than the US. This could be an example to evaluate for extreme risks. Requirement: - extensive database is needed - Important to mention that the software solution is not embedding privacy. So, software only observes the metrics and identifies patterns in rec - Build the nature of software: First, we are cautious about the area that is been monitored. This is a super powerful technology; like Superna responsibilities. -> Some policies limit and restrict the interaction with certain countries - essential to assess human rights on AI Limitations: - We can rely on algorithms during normal conditions or highly predictable crises but not on events with extra risks. You have an extreme risk or reason is that humans are much better at dealing with uncertainty and deciding quickly, especially when hard choices are required.
Expert 2	Academia/Consulting	Executive Director	07/11/2023	University / Coaching Revenue: N/A Employees: 20 TBL: 7	-First, AI is a paradigm changer. It's not just an incremental development of what existed before. It's more like a species leap, a major shift. In terms of a paradigm shift, nobody really knows what it means. And if that's true, we're trying to use the language of the analog age to describe the post-digital age, which is ridiculous. Currently, fewer than 2,000 people worldwide are on the cutting edge of this technology. This technology is changing our world, and it's managed by institutions, universities, research centers, or corporations. -There's been lots and lots of news of AI, but AI is very, very, very good if you know what you want to do. If you want to study formation of viruses, AI is brilliant. So if it is task-oriented and it comes to data management at levels that conceptually as humans we have no understanding of, then it's really good. -The challenge is that global organizations aren't good at fast, agile movement, and the rate of change is exponential. -crisis management is not about solutions. Using the word "solution" for crisis management is a category error. You don't have a solution to crises you have outcomes, maybe, but you don't have a solution. -You need to understand wicked problems and non-rational issues. These are problems that can't be rationalized, like poverty or global warming. It's not about defining problems but understanding their complexity. -Crisis management is not a rational problem. A genuine crisis is defined by a conceptual breakdown, a capability gap to understand what has happened, not just a big problem. It's not defined by the external event but the inability to comprehend it. - This ability to recognize patterns is what's at the core of crisis management. In crisis management, you deal with situations that should, by definition, be unique. Each crisis is unique, and you should never face the same crisis twice.	General info: - I'll appreciate it if you didn't use the term "Black Swan" around me. Even Nassim Taleb, the author of the book, has emphasized that the crises Swan isn't about not paying attention; it signifies a paradigm shift rather than a lack of readiness. People tend to label events as Black Swans w/ I'd say these events are comparable to Black Swans, but not because they are unimaginable. Instead, it's because people weren't adequately prepared. Because the concept of Black Swans versus Green Swans. Michelle Boudet's perspective is intriguing. She argues that there are not Black Swan risks. Picture a massive, intimidating chess piece right in front of you. You can't just pretend it doesn't exist. These events could be conceptual possibility is always there. However, genuine Black Swan events, the ones that radically shift paradigms, are exceptionally rare. In 99.99% of the root cause is our lack of readiness. We didn't discuss enough attention or resources. If we had been better prepared, it would have prevailed much more effectively. Risks: - So, this could be a significant risk of AI—exacerbating social inequality even further. It's not just a matter of using technology; it's about how it then due to the biases within it.
						Potential: - AI can be applied for crisis management purposes in advance. There's a system called Spark developed by the CSIRO that can be beneficial. It's quite impressive. - Black Swan events. Predicting Black Swan events with AI can be challenging due to limited training data. However, with enough data, AI can human observation. It's possible that, with sufficient data and advanced AI, predicting Black Swan events could become more feasible. What? AI can complement each other. - Human factor: With sufficient data, your predictions become more precise and potentially more accurate. However, the optimal approach is expertise, not to replace humans but to enhance their capabilities. Humans possess intuition and the ability to make complex multi-faceted decisions supporting or challenging human intuition based on its results.

Appendix 3.4: Exemplary Evaluation of Transcripts (conducted)

Number Interviewpartner	Profession background	Position	Date	Classification of the company / profession	Understanding & status quo AI & CM	Needed requirements, potentials and limitations of AI in CM context
Expert 1	Academia/Industry	Academia: MBA Director Compliance & Risk Management Industry: Head of Group Risk and Control	30.10.2023	Industry: Software Revenue: 220.6 USD Academic Employees: 1000 TBL: 9	Industry: really high technology readiness score (8) as company works with vision-based AI algorithms -Applications in industry setting: vision-based analysis of theft detection, fall identification of patients in hospitals by analyzing incident patterns Academia: one of leading experts in the field of risk management and compliance at a top business school with interest in process-related machine learning and algorithmic prediction Understanding of AI: prediction and preparation, decision-making, strategic control and measurement, and organizational learning	Requirements: - extensive database is needed - important to mention that the software solution is not embedding privacy. So, software only observes the metrics and identifies patterns in rec - limit the misuse of software: First, we are cautious about the area that is been most policies limit and restrict the interaction with certain countries - essential to assess human rights on AI Limitations: - In the monitoring and prediction phase, preventing consistency issues is key. - Availability of training data poses a challenge, especially for detecting rare incidents "Black swan" events, where manual intervention is preferred due to human adaptability - Mathematical models and patterns, illustrated by the Black-Scholes Model algorithm significant changes not represented in training data. - Humans advanced in fast decision making (especially hard choices) Potential: - AI tools show promise in detecting, managing, and restoring services during business cybersecurity. - Continuous monitoring for cybersecurity threats, such as attacks or communication / repairing algorithms for improved speed and quality. However, reliance on algorithmic feedback data and performance measurement contribute to reducing false positive or refine the algorithm's capabilities.
Expert 2	Academia/Consulting	Executive Director	07/11/2023	University / Coaching Revenue: N/A Employees: 20 TBL: 7	AI is described as a paradigm changer, representing a major shift comparable to a species leap rather than an incremental development - difficult to understand the conceptual gap between the old and new paradigms and acknowledges the transformative nature of AI - limited human resources with expertise -> technology is changing our world, and it's managed by institutions, universities, research centers, or corporations requirement: defined automation level needs to be defined for black box for task automation and pattern recognition - no Black Swan events as 99% of crisis classes have happened before / can be modeled CM involves dealing with unique situations, understanding their complexity, and relying on recognition-primed decision-making to make sense of crises -> no solution-only outcomes - challenges of applying traditional problem-solving approaches to wicked problems like global crises - Status quo / rapid pace of technological evolution, the unpredictability of future outcomes, limited number of people at the cutting edge of AI technology, challenges in governance and adaptation by traditional structures to the exponential changes in AI	Potential: - AI improve crisis decision-making through pattern recognition. - Valuable for quick analysis in data-intensive crises. - Enhances understanding and effective crisis management. Requirements: - Task-oriented AI with clear algorithms and agile governance. - Involvement of young minds in AI discussions. - Integrating AI for pattern recognition in crisis models. Limitations: - Unpredictable AI evolution, lack of global governance readiness. - Human decision-making remains crucial. - Concerns about biases, potential social inequalities. - Skepticism toward trusting corporations in AI development. - Challenge in understanding AI's paradigm shift. - AI susceptible to human factors, raising potential negative consequences. Risks: - I reverted to our old ways, driven by human greed and stupidity -> if we don't address centralization of powers - Decision making challenging as algorithms, created by humans and can carry inher - increasing social inequality - Bias in training data and algorithm model
						Potential: - AI can enhance recognition-primed decision-making in crisis situations by recognizing processes vast data for quick analysis, improving predictions and crisis understanding - Task-oriented prediction. Use vision checks or face recognition, show AI effectiveness

Appendix 3.5: Exemplary Evaluation of Finding (detailed)

Potentials	Limitations	Requirements	Tools	Notes	Crisis management phase	Interviewpartner	Leading professional background	Size of business (#employees)
	represented in training data				General	Expert 1	Academia / Industry	1000
	Consistency issues				Prediction	Expert 1	Academia / Industry	1000
	Data availability / data quality				General	Expert 1	Academia / Industry	1000
	Humans advanced in fast / multilayered decision making				General	Expert 1	Academia / Industry	1000
	training data missing for rare incidents				Prediction	Expert 1	Academia / Industry	1000
				Camera-based monitoring software	Prediction	Expert 1	Academia / Industry	1000
Deeper understanding of correlation dynamic unclear					General	Expert 10	Industry	185000
fast data based analysis					Prediction	Expert 10	Industry	185000
KPI analysis and recommendations / alerts					Decision Making	Expert 10	Industry	185000
Prevention phase incl. Black swans					Strategy Control	Expert 10	Industry	185000
random variable models to increase imagination					Prediction	Expert 10	Industry	185000
Stament generation					Strategy Control	Expert 10	Industry	185000
Task coordination					Strategy Control	Expert 10	Industry	185000
			Alert Media		General	Expert 10	Industry	185000
			Everbridge		General	Expert 10	Industry	185000
			OODA loop		General	Expert 10	Industry	185000
			Rectec Open Project		General	Expert 10	Industry	185000
			ServiceNow		General	Expert 10	Industry	185000
Cost effectiveness of AI tools					General	Expert 10	Industry	185000
human factor					General	Expert 10	Industry	185000
Psychological aspects					General	Expert 10	Industry	185000

Appendix 3.6: Overview of Identified Potentials, Limitations, Requirements and Tools

Potential and limitations of AI in crisis management						
Potentials	Limitations	Requirements	Tools	Crisis management phase	Interviewpartner	
		Accuracy and robustness		General	E3	
		Data Base, Quality and Interpretation		General, Prediction	E12, E1, E2, E9	
		Trust		General	E9, E3	
		Transparency		General	E15, E9	
		Training		General	E5, E7, E15	
		Education/Awareness		General, Decision Making	E6, E9, E13, E15	
		Commitment		General, Decision Making	E5, E6, E12	
		Ressource Availability / Allocation		General	E7, E12, E13	
		Know How, Expertise		General	E7, E8, E4	
		Agile Governance Models		General	E3, E2	
		Ethics (Privacy, human rights, etc.)		General	E7, E1	
		Limit Bias / Misuse		General	E1, E4	
		Human Ground		General	E5	
		Regulations / Governance		General	E3, E6	
		Feedback tracking of all factors for retraining algorithm		Strategy Control / Organizational Learning	E1	
		Mindset (machines more advanced)		General	E4	
		Recognition-primed decision making		Decision Making	E2	
		Definition of roles / collaboration		General	E4, E5	
		Task-orientated problem definition		General	E3	

Potentials	Limitations	Requirements	Tools	Crisis management phase	Interviewpartner
	System Bias (Model/Data)			General, Decision Making, Strategy Control	E2, E3, E6, E11
	Liabilities			General, Decision Making	E2, E5, E6, E8, E11, E16
	Trust			General, Decision Making	E2, E4, E8, E11
	Robustness			General	E8
	Responsibility			Decision Making	E8, E13
	Ressource allocation / intensity			General	E2, E5, E10, E11, E14, E16
	Data availability			General, Prediction, Decision Making	E1, E4, E13, E14, E15
	Data quality			General	E1, E4, E5
	Hard Choices / Black Swan			General, Decision Making	E1, E3, E7
	Emotional Intelligence / Empathy			General, Organizational Learning, Strategy Control	E3, E6, E7, E8, E11, E13
	Human Factor (i.e. experience)			General, Decision Making, Strategy Control	E1, E2, E12, E10, E15, E6, E3, E1, E8, E16
	Ethical Restrictions			General	E3, E4
	Ego / Centralization of power			General	E3, E6, E10
	Input Interpretation (Soft Facts)			Decision Making, Organizational Learning	E2, E13
	AI Ressource and Capability			General	E6, E11, E14, E5, E16
	Time pressure			General, Prediction, Organizational learning	E10, E5, E15, E4, E14
	Model Development & Assumptions			General, Prediction	E1, E2, E3, E13, E16, E4
	Behavioural and Soft Skills			General, Decision Making, Organizational Learning	E6, E2, E6, E3
	Consistency and Reevaluation			Prediction, Decision Making	E1, E14, E6
	Connection and Experience (longterm thinking)			General, Organizational learning, Decision Making	E6, E13, E16
	System dependency			General	E4, E6, E16
	Accuracy and tone			Strategy Control	E3
	Performance & Tracking			Strategy Control	E7, E13

Potentials	Limitations	Requirments	Tools	Crisis management phase	Interviewpartner
Reduction of Bias -> Increase Rationality				General, Prediction, Decision Making	E16, E7, E9, E6
Faster Processes / Efficiency				General, Decision Making, Organizational Learning	E10, E4, E9, E16, E2
Error Reduction (Human)				General, Prediction, Decision Making	E9, E12, E11
Real Time Advantages				Prediction, Decision Making	E3
Understanding of Correlation und Consequences				General, Prediction, Organizational learning	E2, E4, E5, E6, E7, E10, E15
Cyber Security / Threats				General, Prediction, Decision Making	E5, E1, E7
Patter Identification / Recognition				Prediction	E1, E2, E3
Detection Early Signs/Trigger				Prediction	E5, E8, E12
Data Driven Insights & Decision Making				Prediction, Decision Making, Organizational Learning	E1, E2, E3, E4, E6, E7, E16
Scenario Planning / Forecast / Prediction				Prediction	E2, E3, E4, E5, E6, E8, E10, E11
Gap Identification				Organizational Learning	E4, E6, E8
Simulations / Scenario building				Organizational learning	E5, E6
Models for complex situations				Prediction	E4 E5, E10
Crisis Communication				Strategy Control	E2, E3, E5, E7, E8, E13, E16
Task Coordination				Strategy Control	E5, E8, E10, E15
Simplification / Processing of complex situations with data				General, Prediction	E2, E3
Prediction / Prevention Black Swan				Prediction	E3, E4, E10
KPI / Tracking				Strategy Control	E5, E10, E11, E15, E16
Stakeholder Identification / Management				Strategy Control	E11, E14
Accuracy				Decision Making	E4
Media Tracking / Monitoring				Prediction	E2, E5, E7
Crisis Response Plans				Strategy Control	E13, E16
Automation				General, Strategy Control	E11, E15, E16
Training Conclusions				Organizational Learning	E7, E14, E16, E6, E4
Back-Office / Project management				Prediction, Strategy Control, Decision making, Organizational learning	E7, E8, E10, E11, E12, E15, E16
Impact Qualification				Strategy Control	E5
enhance recognition-primed decision-making // autocratic decision making				General, Decision Making	E3, E16
Decision Preparation and Recommendations				General, Decision Making	E4
Experience				General	E4
Efficiency / Reduction in Ressources				General	E1, E7, E8, E9, E11, E16
Decision Making				Decision Making	E1
Potentials	Limitations	Requirments	Tools	Crisis management phase	Interviewpartner
			Alert Media	General	E10
			AVA	Prediction	E13
			business continuity software solutions	Organizational learning	E7
			Crisis leadership protocol	Strategy Control	E6
			crisis scan	Prediction / Organizational learning	E6
			Crisis24	Prediction	E13
			CrowdStrike	General	E5
			Everbridge	General, Prediction	E10, E13
			OODA loop	General	E10
			Rectec Open Project	General	E10
			RSM (catastrophe modeling)	General	E5
			ServiceNow	General	E10
			OnPoint (CSA)	Strategy Control	E6
			CrisisCom (CSA)	Strategy Control	E6
			Crisis Ecademy (CSA)	Organizational Learning	E6
			CrisisMediaSim (CSA)	Organizational Learning	E6
			CrisisStockScenario (CSA)	Organizational Learning	E6
			PublicSonar (Social Media Monitoring)	Prediction	E6

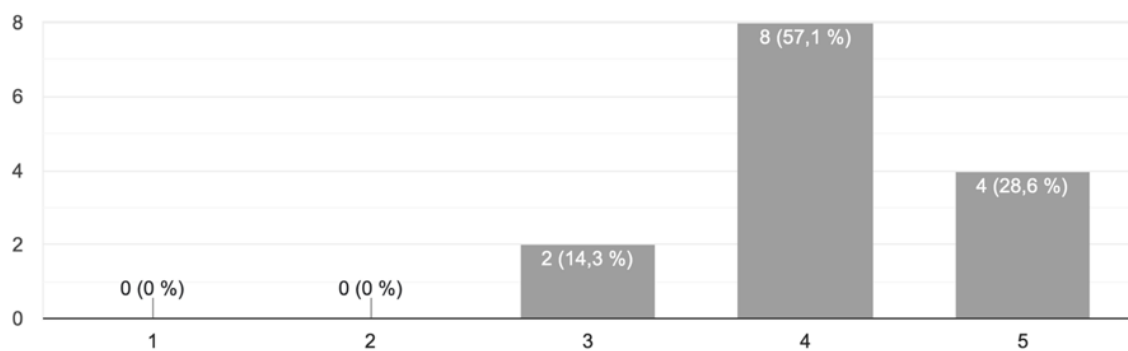
Appendix 4: Overview of Back-Testing of Identified Applications

Appendix 4.1: Survey-Results for Applications in Early Detection and Preparation

Please give your estimations towards the following implication: AI-driven data collection not only facilitates data gathering but also improves its accuracy by incorporating vast amounts of historical and real-time inputs.

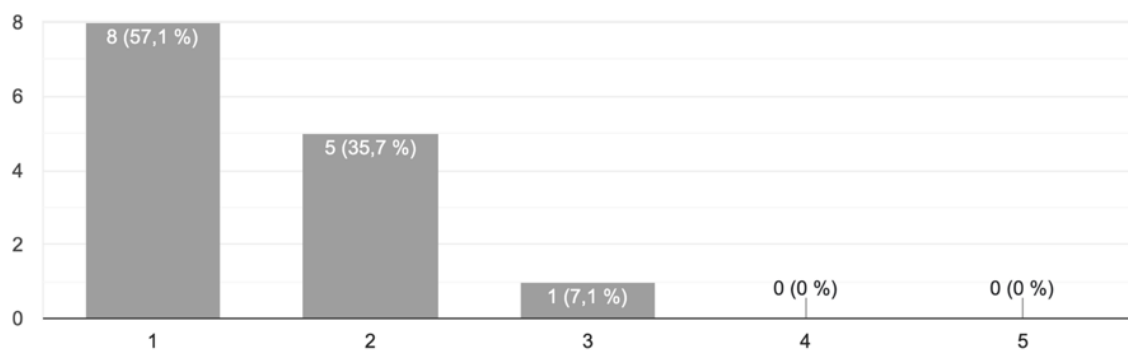
Please indicate your estimation of the implication in the applicability towards different scenarios.

14 Antworten



Please indicate your estimation of the implication in the applicability towards the involvement of human interaction needed.

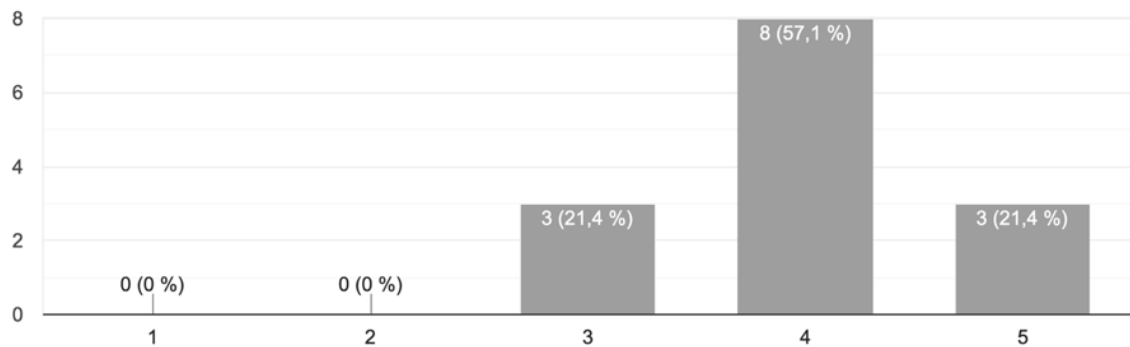
14 Antworten



Please give your estimations towards the following implication: By incorporating automated data processing, AI has the capacity to facilitate the early identification of triggers, offer GenAI based filtering and bundling options for various purposes (such as scenario building or prioritization), and continuously monitor ongoing actions to make adjustments when necessary.

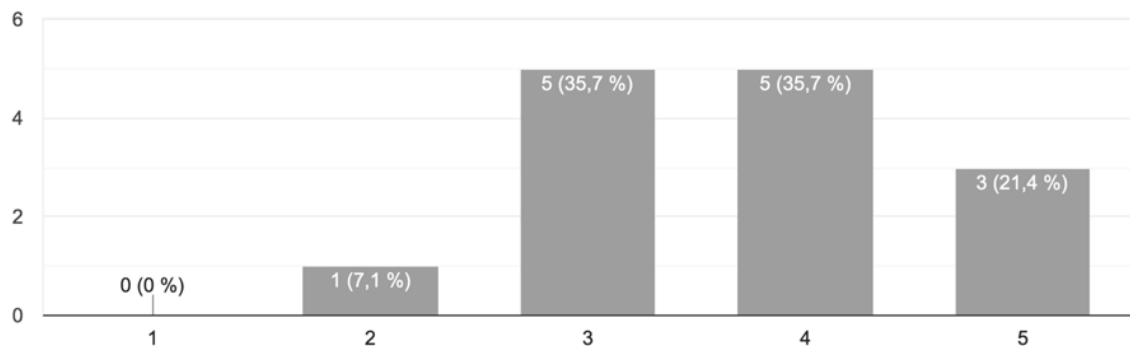
Please indicate your estimation of the implication in the applicability towards different scenarios.

14 Antworten



Please indicate your estimation of the implication in the applicability towards the involvement of human interaction needed.

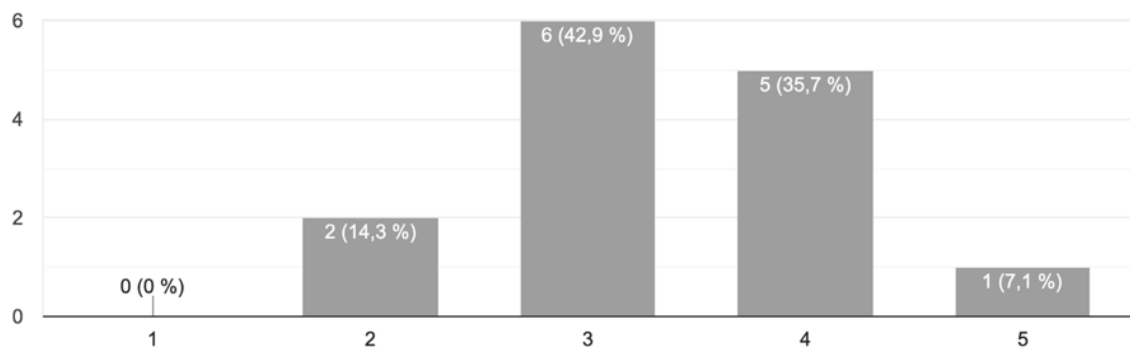
14 Antworten



Please give your estimations towards the following implication: By employing AI-driven countermeasures against attacks, initial threat indicators can be categorized as highly critical (e.g., cyber attacks), triggering an automatic shutdown or pause of systems to mitigate and prevent additional damage or potential crises.

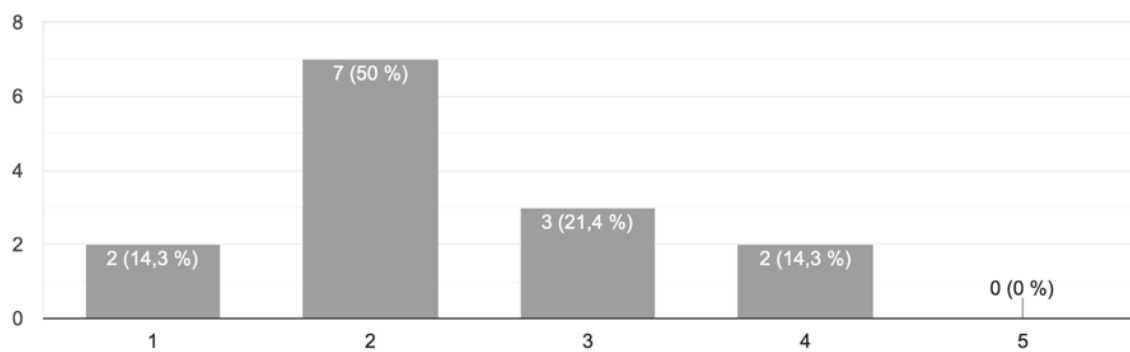
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Please indicate your estimation of the implication in the applicability towards the involvement of human interaction needed.

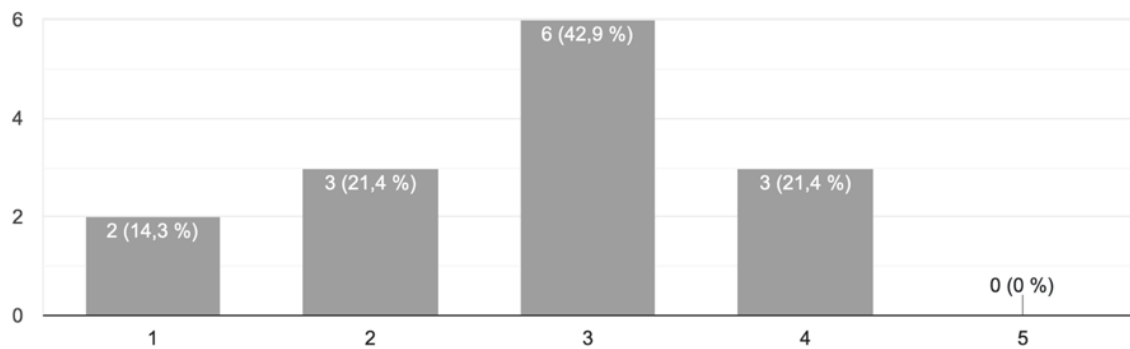
14 Antworten



Please give your estimations towards the following implication: Using Natural Language Processing and Chatbots can help immediate crisis response systems provide prompt guidance and answers to employees or affected parties, preventing harmful actions and crisis escalation.

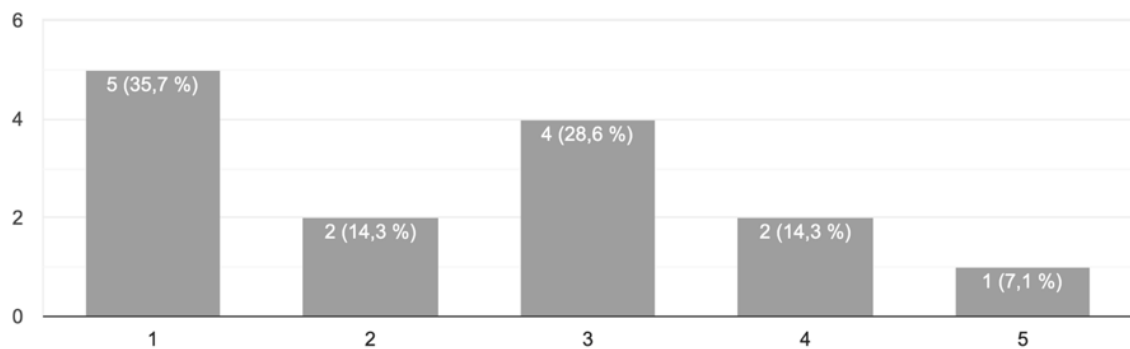
Please indicate your estimation of the implication in the applicability towards different scenarios.

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Please indicate your estimation of the implication in the applicability towards the involvement of human interaction needed.

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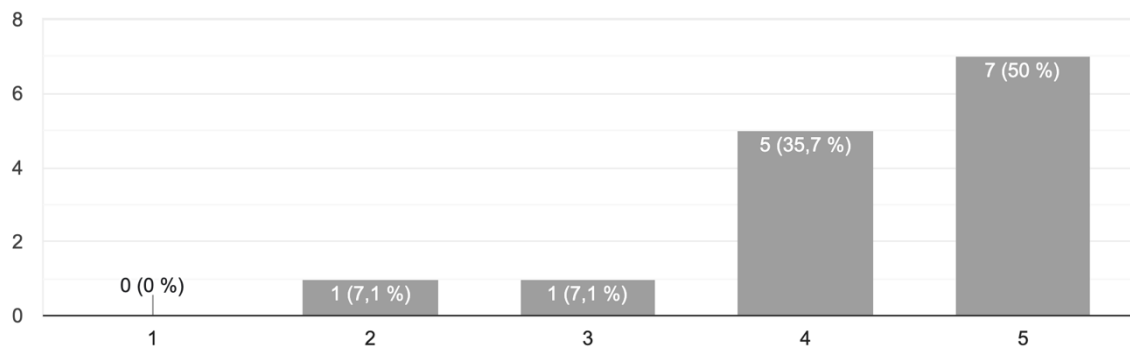


Appendix 4.2: Survey-Results for Applications in Decision Making

Please give your estimations towards the following implication: By employing GenAI and large language models in tools such as chatbots for internal use, AI can empower decision-makers to gather information and understand problems by analyzing causal relationships and simplifying root causes in data.

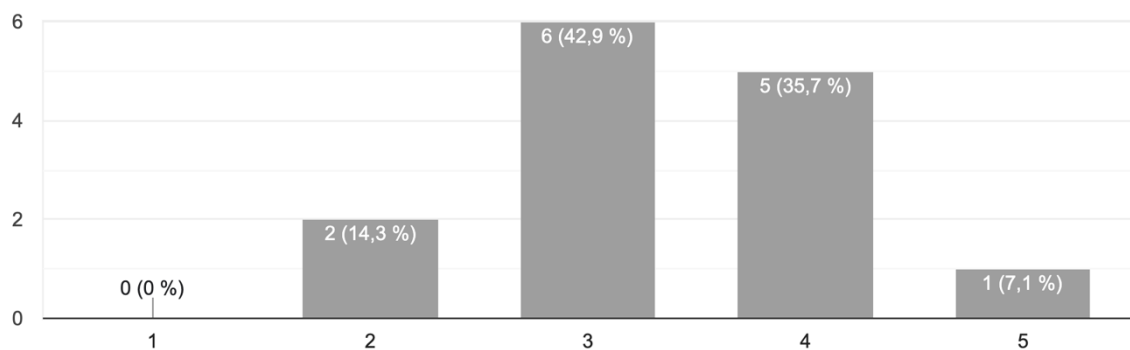
Please indicate your estimation of the implication in the applicability towards different scenarios.

14 Antworten



Please indicate your estimation of the implication in the applicability towards the involvement of human interaction needed.

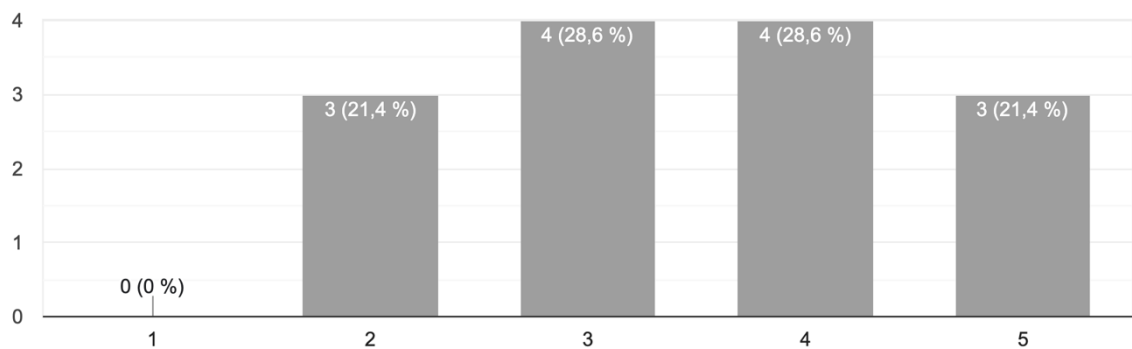
14 Antworten



Please give your estimations towards the following implication: By incorporating GenAI and machine learning in chatbots or strategic tools such as scenario planning, or multi-criteria decision-making methods, AI can enable the generation of diverse decision options and alternatives.

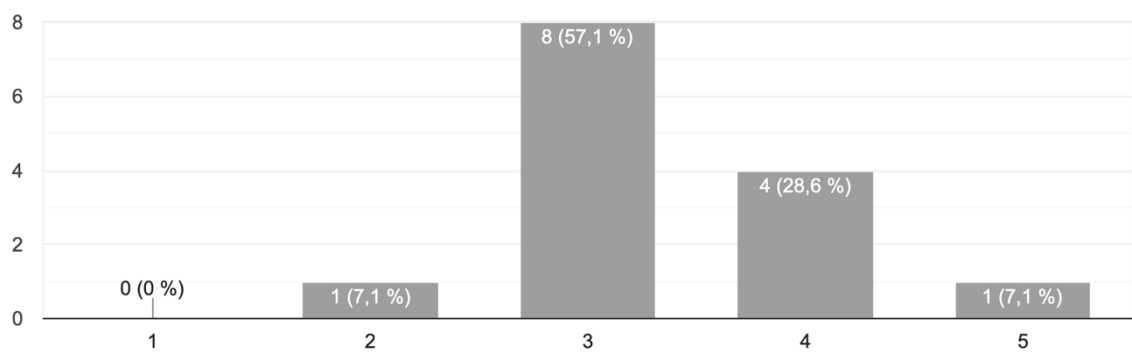
Please indicate your estimation of the implication in the applicability towards different scenarios.

14 Antworten



Please indicate your estimation of the implication in the applicability towards the involvement of human interaction needed.

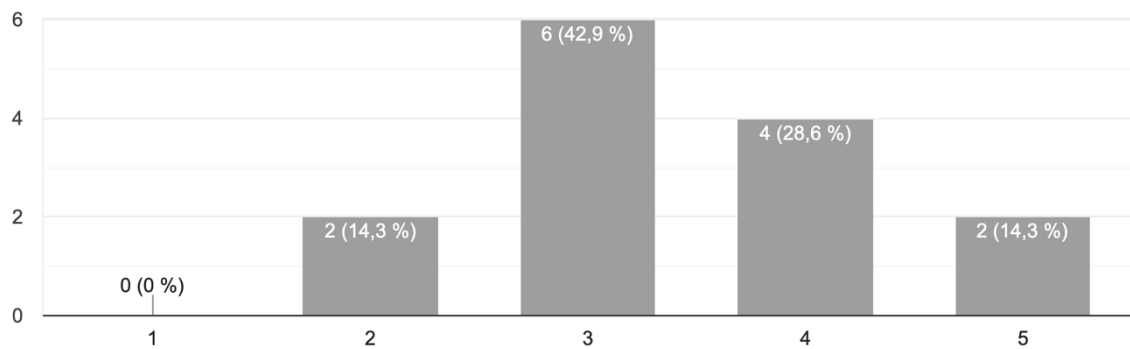
14 Antworten



Please give your estimations towards the following implication: By integrating GenAI into chatbots or strategic tools like Scenario Planning, AI can enable rapid testing, adaptation, and feedback for diverse decision outcomes in dynamic environments.

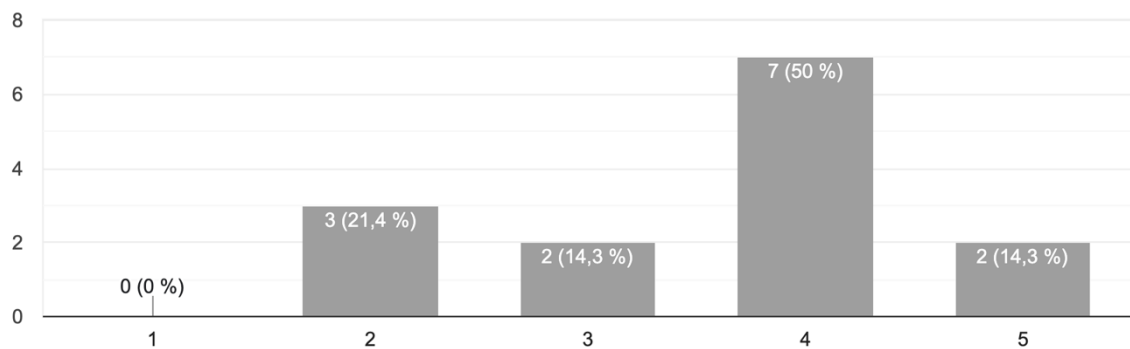
Please indicate your estimation of the implication in the applicability towards different scenarios.

14 Antworten



Please indicate your estimation of the implication in the applicability towards the involvement of human interaction needed.

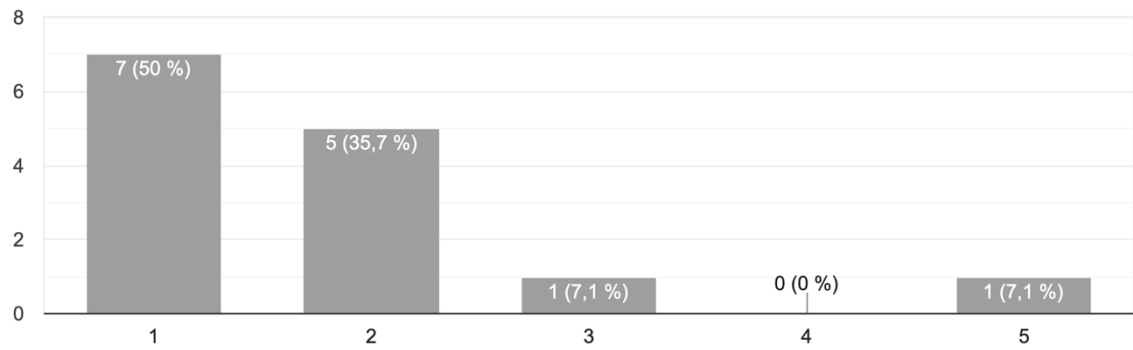
14 Antworten



Please give your estimations towards the following implication: By utilizing AI in data-intensive and low-complexity crisis scenarios, AI has the potential to facilitate automated decision-making processes.

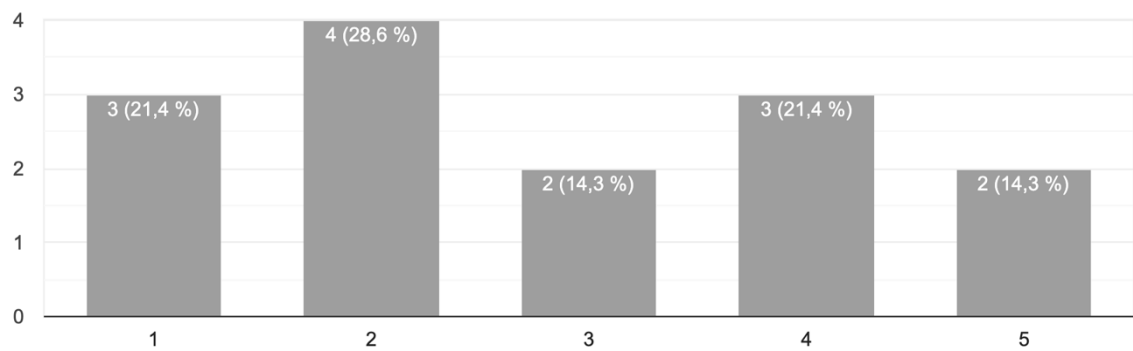
Please indicate your estimation of the implication in the applicability towards different scenarios.

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Please indicate your estimation of the implication in the applicability towards the involvement of human interaction needed.

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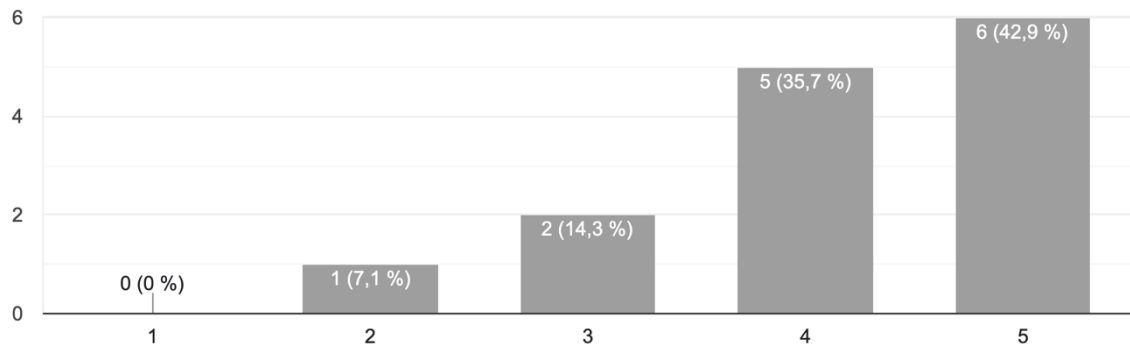


Appendix 4.3: Survey-Results for Applications in Strategy Implementation and Control

Please give your estimations towards the following implication: AI can be utilized to generate crisis response statements for external communication during a crisis using GenAI models.

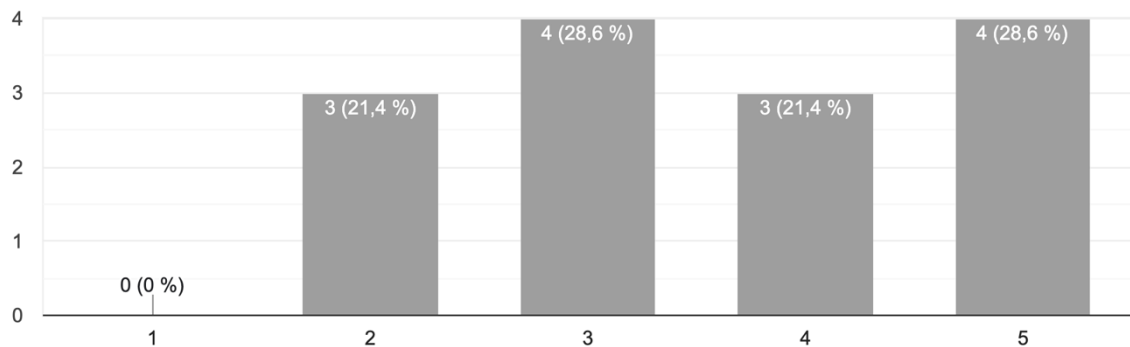
Please indicate your estimation of the implication in the applicability towards different scenarios.

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Please indicate your estimation of the implication in the applicability towards the involvement of human interaction needed.

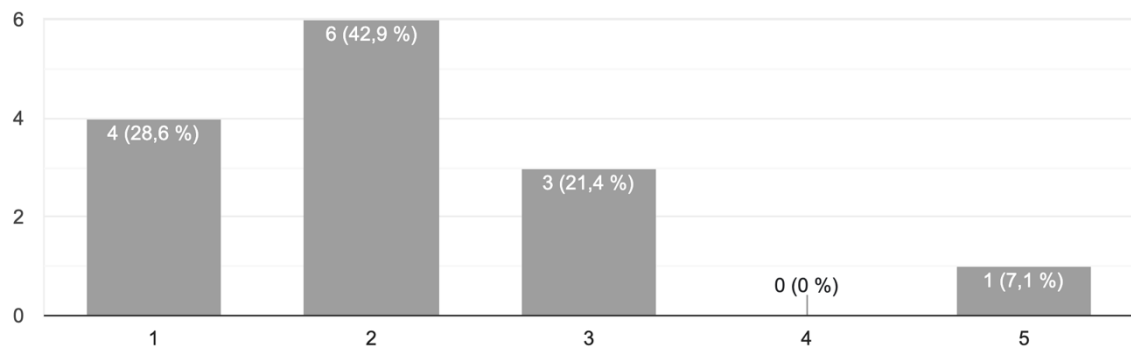
14 Antworten



Please give your estimations towards the following implication: GenAI chatbots can be used for target group-oriented information of crisis response plans by segmenting stakeholders into groups and addressing them in the right tone.

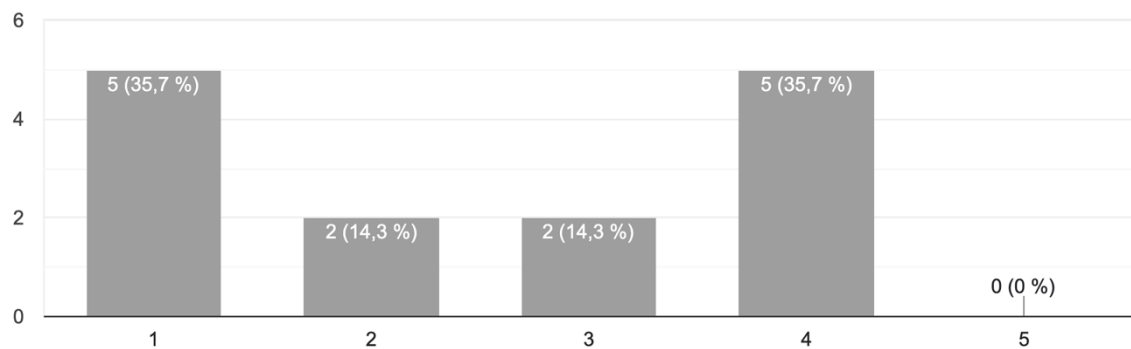
Please indicate your estimation of the implication in the applicability towards different scenarios.

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Please indicate your estimation of the implication in the applicability towards the involvement of human interaction needed.

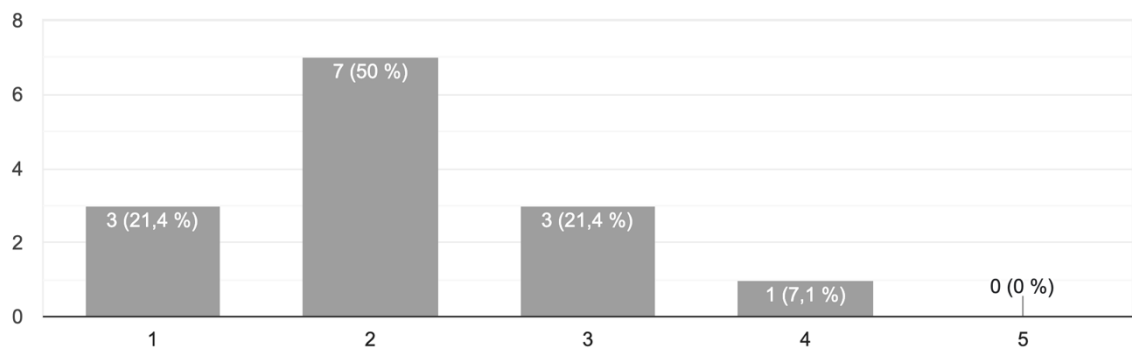
14 Antworten



Please give your estimations towards the following implication: AI can be used to select crisis management team members and relevant middle-managers to execute decisions and crisis management plans by analyzing the internal talent pool and required team roles, i.e., based on a shared mental model analysis.

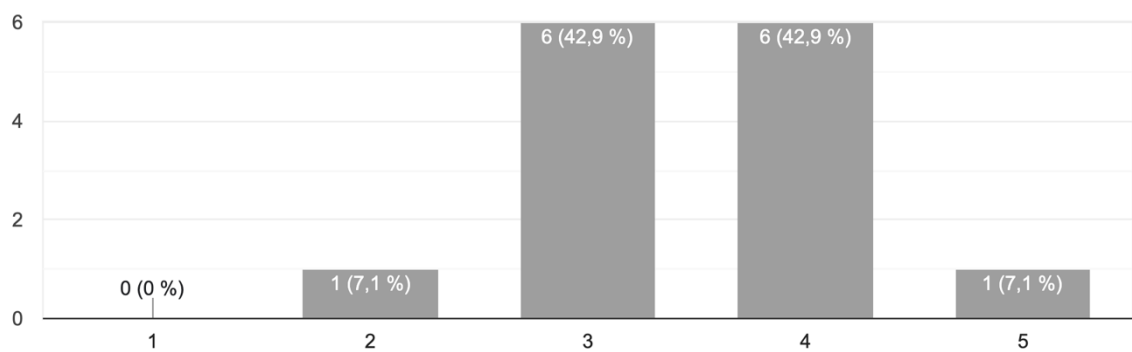
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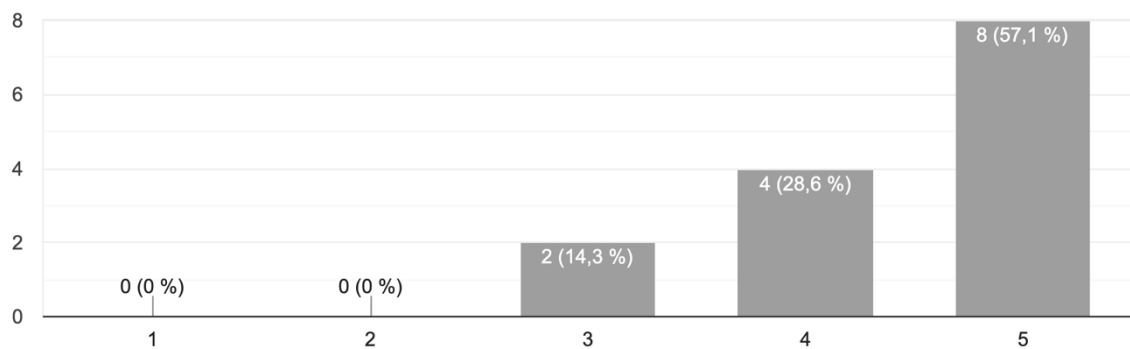
14 Antworten



Please give your estimations towards the following implication: *AI can improve project management efficiency through automation of back-office tasks, such as converting meeting transcripts into action items, delegating them to relevant personnel in mid-crisis management, and coordinating the tasks among them.*

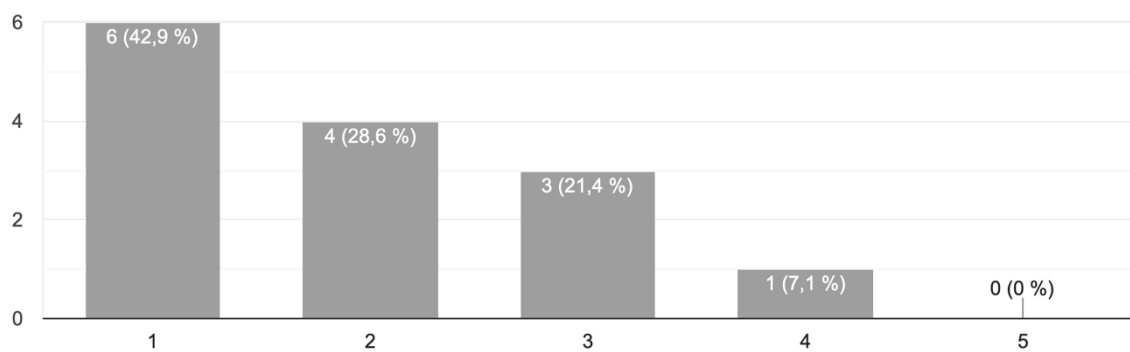
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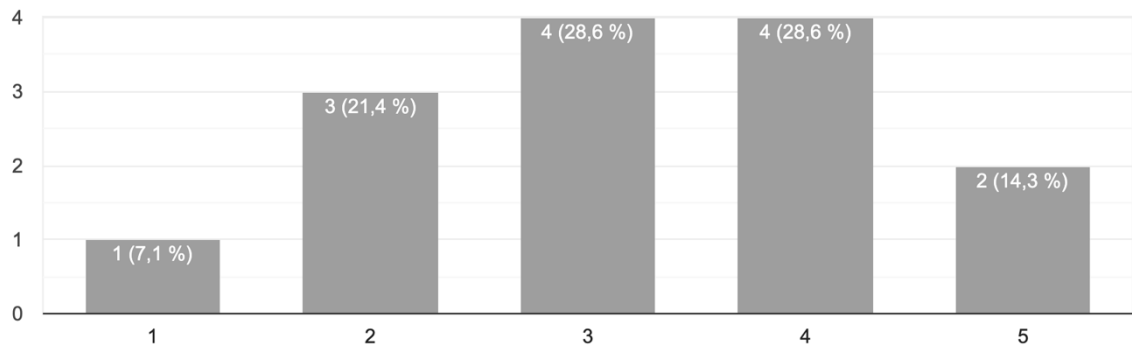
14 Antworten



Please give your estimations towards the following implication: AI can increase performance tracking and evaluation by generating AI-powered KPIs that analyze real-life data (i.e., social media monitoring) on crisis response.

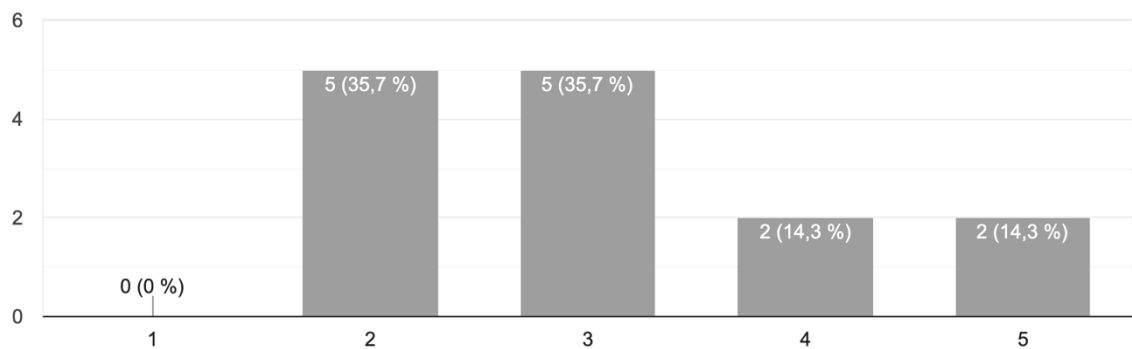
Please indicate your estimation of the implication in the applicability towards different scenarios.

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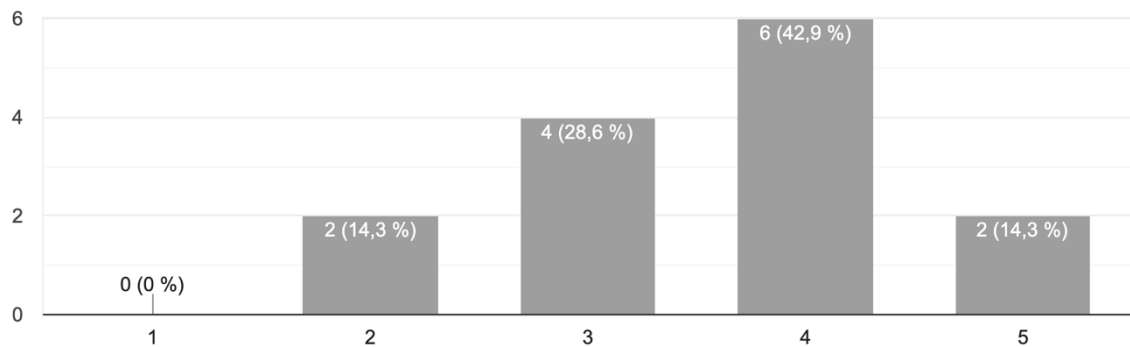


Appendix 4.4: Survey-Results for Applications in Organizational Learning

Please give your estimations towards the following implication: AI positively impacts post-crisis analysis by leveraging After-Action Reviews to more efficiently identify and address skill gaps and business needs.

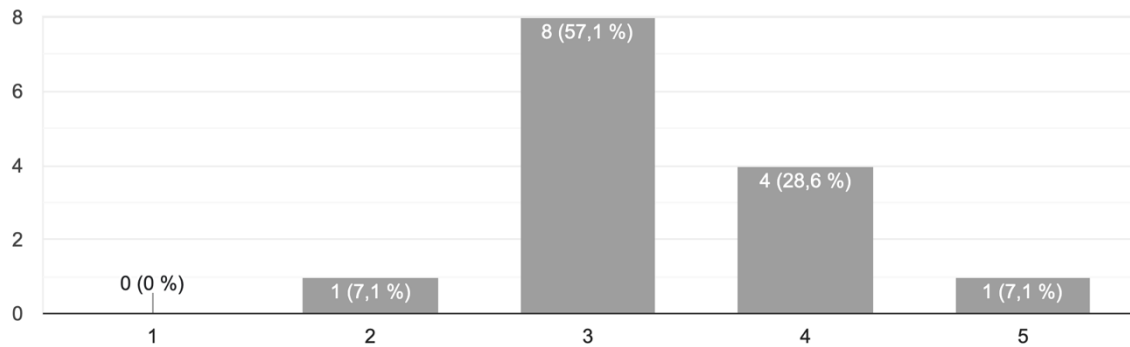
Please indicate your estimation of the implication in the applicability towards different scenarios.

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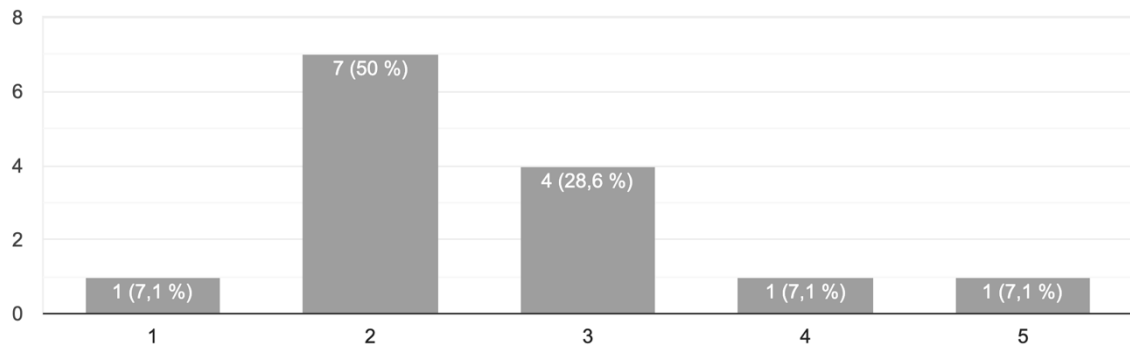
14 Antworten



Please give your estimations towards the following implication: AI enhances learning support by utilizing Natural Language Processing and chatbots, offering impactful virtual learning assistance and engagement.

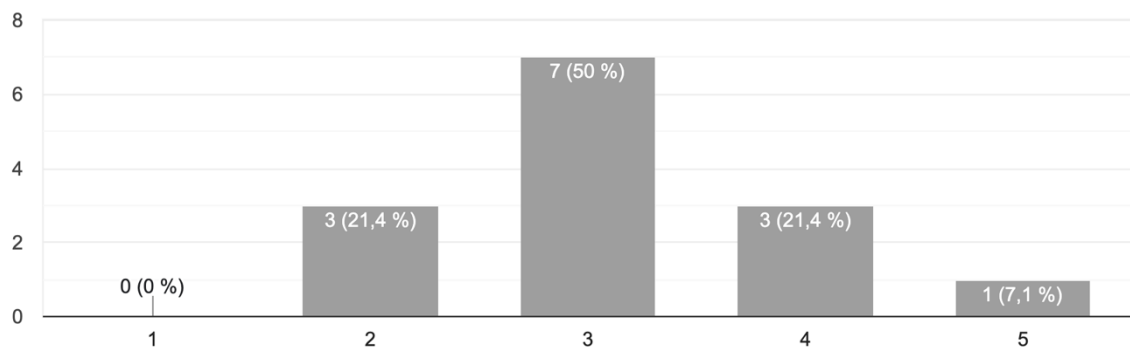
Please indicate your estimation of the implication in the applicability towards different scenarios.

14 Antworten



Please indicate your estimation of the implication in the applicability towards the involvement of human interaction needed.

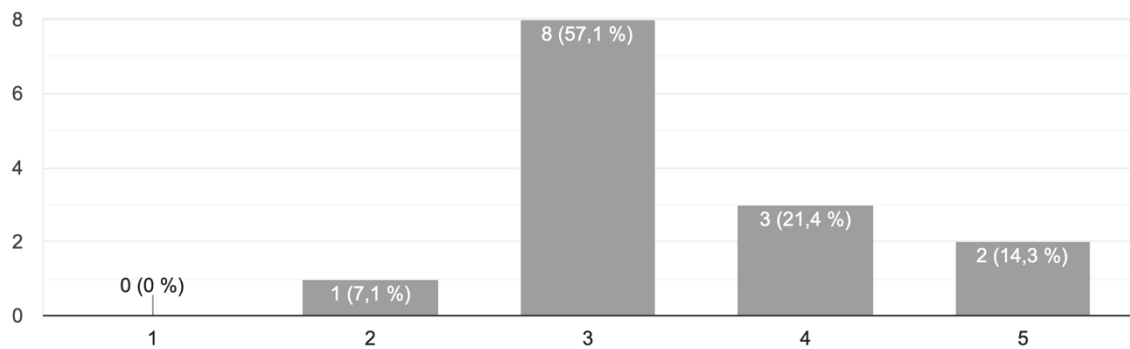
14 Antworten



Please give your estimations towards the following implication: AI-driven reflection sessions within agile retrospective teams empower businesses to optimize learning from previous crises, enhancing interactive learning modules.

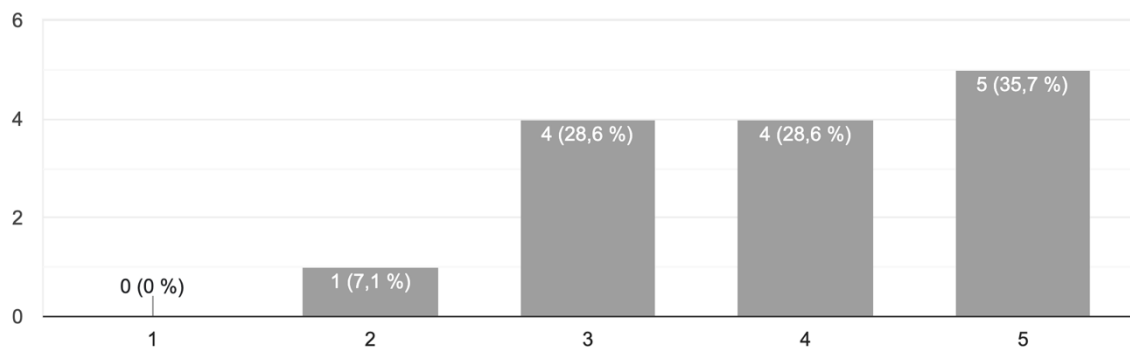
Please indicate your estimation of the implication in the applicability towards different scenarios.

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Please indicate your estimation of the implication in the applicability towards the involvement of human interaction needed.

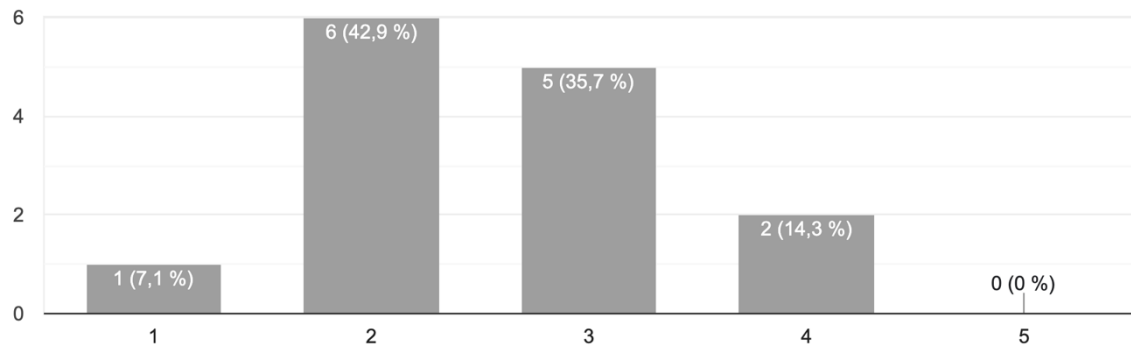
14 Antworten



Please give your estimations towards the following implication: AI-driven learning platforms and assessments positively contribute to post-crisis learning by offering personalized and adaptive learning experiences.

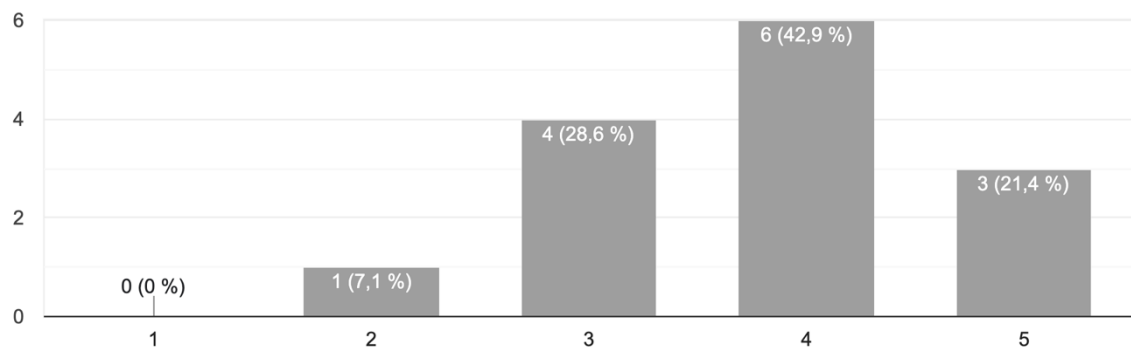
Please indicate your estimation of the implication in the applicability towards different scenarios.

14 Antworten



Please indicate your estimation of the implication in the applicability towards the involvement of human interaction needed.

14 Antworten



Appendix 5: Overview of Interview Transcripts

Appendix 5.1: Expert 1

Transcript for the expert interview

About the master thesis "*Artificial intelligence in crisis management - an analysis of potentials and limitations to enhance top management responses as part of business resilience.*"

Name: E1

Company: Anonymous

Position: MBA Director Compliance & Risk Management; Head of Group Risk and Control

Email address: Anonymous

Interviewer: Niklas Mauer

Date: 30.10.2023

Interview Objective:

This survey aims to facilitate dialogue among crisis management, AI experts, and Nova SBE students. In doing so, an exchange of information will take place that targets the topic of "Artificial intelligence in crisis management."

Niklas Mauer: Please introduce your role and the company you represent and highlight your touch points in artificial intelligence or crisis management. Considering your work environment, company size, and industry – how would you rate the technology readiness level¹ and adaption of relevant stakeholders/clients?

E1: I have been involved with risk, privacy, and crisis management over the last 25 years at large organizations and universities. I have been working in America, South & West Europe. I am now more focused on AI due to the hype, but I have been constantly involved in process-related machine learning and algorithms in compliance, fraud, and accounting for a long time. Therefore, I am pretty used to these scenarios. Currently, I work for camara software department, and I teach multiple MBA classes.

Niklas Mauer: As I have seen on LinkedIn at your current company, you are working on software solutions for vision-based theft and accident identification, or?

E1: Yes, and there we use artificial intelligence algorithm. For example, we train from actual or simulated footage. To know that something is happening, an extensive database is needed. A current use case is the identification of a fall in a hospital and then notifying clinical staff via an alarm on the phone telling them they should have a look at the patient. We are not 100% sure what is happening, but the pattern observed by the camera means that it is most likely an incident requiring some attention.

Niklas Mauer: As I have seen on the homepage, the primary use cases are reducing the shortage of nurses and increasing patient safety. Is there another key element I missed?

E1: These are the main elements, but it's also important to mention that the software solution is not embedding privacy. So, software only observes the metrics and identifies patterns in real-time with AI algorithms.

Niklas Mauer: How do you solve the privacy issue?

E1: First, we are cautious about the area that is been monitored. This is a super powerful technology; like Superman, new superpowers bring high responsibilities. Therefore, imagine you would have software to predict if someone falls into a hospital. You could also misuse the software to predict if there was a kill on the battlefield. You have software that counts how many people attend an event to check that they are not overreaching their capacity. With the same software, you can also calculate how many soldiers will attack you to adjust your strategy. You can detect that someone does not wear a helmet in a restricted area, and a safety officer can reach out to them, but with the same technology, you can detect if a woman is wearing face coverage.

NIKLAS MAUER: How do you solve the issue that the software is not misused? Is there a selection of countries and organizations you supply with the software?

E1: Good question. Some policies limit and restrict the interaction with certain countries, i.e., Iran or North Korea. That's important because the same software that allows the policy to identify someone who committed a crime can be used to follow people in a demonstration, identify them, and arrest them. Generally, it is essential to state that the more advanced the AI solution is, the more likely it is to have someone trying to misuse it. And also, it is essential to assess human rights on AI. Therefore, I'll also share a class document with you to expand on that issue.

NIKLAS MAUER: That would be great, as we will have a section in our thesis discussing the ethical aspects of AI and trying to focus on the interview guide. After talking about your current role at the company, I want to highlight your role as a risk consultant and professor. I would like to challenge our crisis management framework with you. We identified four phases: prediction and preparation, decision-making, strategic control and measurement, and organizational learning. Would you cluster the process similarly, or how do you press the process during your classes? And could you give examples of tools and processes to improve each part with AI?

E1: Good. There is a tool for AI in detecting, managing, and restoring services in business continuity incidents. You can use, in particular, a piece of software for monitoring and predicting. To predict a crisis, cameras are brilliant, as you can see, but you can measure temperature and patterns as well as patterns in sound. It does not only know. It feels like sensing sound; therefore, you can easily predict that a specific factor is triggering a business continuity plan. Then, you are using video monitoring to manage the plan, like for evacuation. You can do the counting to improve the work of the floor driller. As you can see, it's essential to differentiate between incidents. About which intendants would you talk as well

NIKLAS MAUER: Could you also talk further about incidents in cyber security you said during your introduction that you had touchpoints there as well.

E1: Cybersecurity is an entirely different thing. In cyber security, you need to check continuously if there is a cyber security attack instead of focusing on the event only. Another thing is a communication failure, i.e., storing footage in AWS and they are recording the data but not going through the cloud. In that case, you are receiving an e-mail/message saying: out

of capacity, the service is not running, and as part of the software, when it is integrated, any unusual moment in data is atypical.

NIKLAS MAUER: This would be part of the detection phase when trying to connect it to our four process steps. And as Amazon is tracking these continuously, the fraud analysis could fit into the prediction phase. How could decision-making and other phases could be supported by AI?

E1: There are many business cases where AI is used for monitoring. In cyber security, it is most commonly used to detect phishing and spamming. An algorithm can be easily trained, for example, by programming that a trigger is pulled if certain content or IP is used. Another thing that is always covered in cyber security is a denial of services. If minor activity is, for instance, triggered in China -connections are filtered to analyze the effect. In a denial service attack, there is a series of service actions to overload services and shut down operations. Therefore, they ask many servers to do activities on your website that require many services, i.e., product selection. These attacks are easy to detect as minor activities can be linked to the server, and robots can be identified. Therefore, automated decision-making blocks activities from this threatening server quickly.

NIKLAS MAUER: How are these decisions made, and what is the level of automation?

E1: In cyber security, most decisions are made through an algorithm that automatically triggers a contingency control plan. They filter, block, and cancel as patterns are easily identifiable. Therefore, they kick out users automatically and block them in the future. Transactions are parked as it doesn't make sense that customers access from different countries. Afterward you retrain the algorithm to improve speed in the future. If a human customer interacts with service feedback, data is used to reduce false positive errors, and algorithms are high-speed to identify all clues to detect patterns.

NIKLAS MAUER: So, user identification is relevant?

E1: Yes, as feedback data is essential to improve quality.

NIKLAS MAUER: I'm trying to connect what you said with the process steps. Can the retraining and monitoring be linked to the performance measurement phase? And if so, what KPIs are most relevant to track during these events?

E1: Feedback data is continuously produced, and it is essential to track it during the performance measurement phase to reduce false positive errors. With that, the algorithm can be improved. After retraining, backtesting is relevant. This means it increases the quality by focusing on specific patterns that had an impact in the past.

Regarding limitations, the key to having AI in the monitoring and prediction phase is to prevent consistency issues. However, it is tough to train an algorithm to detect issues in business continuity. The reason behind this is that incidents triggering the business continuity protocol are pretty rare. Maybe you have a ransomware attack once every three years. So, you only have little data to train the algorithm. This is a hard limitation; therefore, there is no clear link between AI and business continuity. I can see a benefit for preventing an incident with AI, but not for business continuity. Even if you simulate multiple scenarios, you can not train an algorithm for sensible decision-making. The idea of having an AI algorithm is to make a manual automatic, but when it comes to risks that are "black Swans," you always go manual. For

Instance, a pilot is using autopilot for everyday conditions. But if there is an emergency, the first thing is disconnecting the autopilot and removing artificial intelligence.

NIKLAS MAUER: Rephrasing what you said, the main issues are data quality and the availability of training data. Furthermore, the algorithm is not strong enough for events with high unpredictability.

E1: We can rely on algorithms during normal conditions or highly predictable crises but not on events with extra risks. You have an extreme risk of crashing a plane or a car. The reason is that humans are much better at dealing with uncertainty and deciding quickly, especially when hard choices are required.

Another example to show risk management's relevance is the Black-Sholes-Model algorithm. The two mathematicians create a formula to predict whether a stock option is undervalued or overvalued. According to the risks, they had a formula to tell if someone was paying too much or too little for an asset. They used the algorithm to sell stocks to the people overpaying and bought them from people charging less than the actual value. In the 90s, they could generate 400bn with this algorithm. They created a sharp formula to detect the risk for the first time in humankind. However, there was a crisis in Asia in '98. In four days, they almost lost everything because the algorithm accurately detected and decided on average conditions. Still, with the crisis and Thailand defaulting, all stock exchanges changed significantly, confusing the algorithm. They disconnected the servers before they had more debt than the US. This could be an example to evaluate for extreme risks.

Afterward, they published the algorithm, wrote the Nobel price, and still used it in all stock changes to check the value of stock options.

NIKLAS MAUER: Thank you. Would you say with the algorithm we have and new data inputs, the performance measurement improved to improve the algorithm?

E1: The AI is based on assumptions, and the model is only run with these assumptions. If something is unusual, the model is not highly valuable for decision-making as assumptions do not fit.

NIKLAS MAUER: Once again, thank you for your time. Is there anything else you want to add?

E1: One last thing: in science, knowing what is working and what is not is essential. Your thesis will not be better whether you can use AI or not whenever you can discover a use-case or limitation important for research and take this as a lesson for life. You need to be comfortable when finding out things you like are not working.

If you have any further questions, please reach out again and look at my recent LinkedIn post. In general, not many people are discovering this topic yet, and even fewer in Europe. If you go to Silicon Valley, chances are a little higher to find experts, and I am thrilled to learn more about this exciting and essential master's thesis.

Description of interview situation:

Location: Online

Interview recording: Microsoft Teams conference recording was used to secure the data. Thanks to a quiet environment, high-quality audio files could be generated here. These can be accessed via the following link:

Short description of the atmosphere

Duration of Interview: 48min

Feedback:

Appendix 5.2: Expert 2

Transcript for the expert interview

About the master thesis "*Artificial intelligence in crisis management - an analysis of potentials and limitations to enhance top management responses as part of business resilience.*"

Name: E2

Company: Anonymous

Position: Executive Director, Professional for International Crisis Management

Email address: Anonymous

Interviewer: Niklas Mauer

Date: 07.11.2023

Interview Objective:

This survey aims to facilitate dialogue among crisis management, AI experts, and Nova SBE students. In doing so, an exchange of information will take place that targets the topic of "Artificial intelligence in crisis management."

Niklas Mauer: Hi, David.

E2: Hey, Niklas. Hey.

Niklas Mauer: Glad to hear you, and I'm happy that it worked out with the scheduling on my end. Doing well, I just came out of another interview, so it's getting busy now. It's the final steps of the Master's thesis. But yes, it's such an interesting topic.

E2: So, tell me a bit about who you are and what you do and give me some background.

Niklas Mauer: Sure. Yeah, as you know, my name for sure. So, I'm Niklas Mauer. I'm from Germany. I did industrial engineering in my bachelor's. I worked for a couple of years in a mid-size company, primarily in purchasing, where we dealt with supply chain, including semiconductors. Then I decided to go to Nova, which is a Portuguese Business School. I'm currently pursuing my Master's degree in management, and during that time, I worked in consulting at Porsche Consulting. We focused on supply chain resilience and had a major project related to semiconductor and supply chain security. So, these are my connections to crisis management, so to speak.

E2: Good. And tell me a bit about your thesis.

Niklas Mauer: Yes. So, the idea of this thesis is somewhat similar to the workshop you're giving. We observed that there's currently not much research on the combination of AI, which is the current hype, and its applications in crisis management. Within our group of four, we're working on this, and it's like a blend of a Master's thesis and a Ph.D. Each of us has our own assigned topic, and there's an overall theme. The overarching topic is crisis management and AI, and each of us is exploring different aspects of the crisis management process, the implications, as well as the limitations of AI.

E2: Is your Master's an individual one, or are you doing it as a group? How does it work in terms of certification and responsibilities?

Niklas Mauer: It's a bit complicated. The university handles it this way: we had individual classes, and for the Master's theses, it's a mix of a group and individual projects. We're supposed to write about 80 pages, and there's a general part that we write together, which receives one grade with some variations. Then each of us has our own individual section with an individual grade. After that, they combine everything to determine the final result.

Niklas Mauer: Each of us gets an individual grade, but the exact weight of each part is not clear to me.

E2: I was going to ask, but that clears things up. So, good luck with that. So, you've finished the research part and are now in the dissertation writing stage, right?

Niklas Mauer: Yes, we've finished the research part. We delved deeply into crisis management, gathering background knowledge. Currently, we're conducting expert analyses to combine our research papers with LinkedIn posts and integrate them into our work. Right now, I'm working on my individual section, focusing on limitations, potentials, and other related aspects.

E2: What do you want from me?

Niklas Mauer: Hopefully, insights about applications, best practices in using AI for crisis management, and discussions about the limitations. Since you'll be conducting a two-day workshop or conference, possibly in December or November, a brief summary of that workshop would be fantastic.

E2: Let's reverse engineer it from a German perspective. Tell me a bit about your thoughts. Are you bringing a hypothesis or do you have an idea about what you want to convey or the themes you're trying to highlight here?

Niklas Mauer: Our hypothesis is that there aren't many use cases for AI currently, but we believe the technology has potential with some limitations to be applied in the future for crisis management. We want to explore which types of crises, especially in a business context, AI can be used for and where we see potential for predicting crises. From what we've heard from experts so far, they have trouble envisioning the use of AI for events like flash floods, for example, due to the lack of training data.

E2: OK, interesting. Let me talk about some of the things I'm thinking about regarding AI. Then we can have a discussion, and you can ask questions. First, AI is a paradigm changer. It's not just an incremental development of what existed before. It's more like a species leap, a major shift. It's not about making monkeys faster; it's like moving from monkeys to humans. In terms of a paradigm shift, nobody really knows what it means.

E2: I mean, that's what it means. It means that, to use your typewriter analogy, we can't extrapolate from the old paradigm to understand the new paradigm. No matter how clever your typewriter is, you can't use it to comprehend the Internet. It just doesn't work. If you understood how a car worked in 1930, you understood how cars worked in 1990; it was the same. But in 2000, it was all about computer chips. So if you understood cars, it's like having a spanner and a hammer, but now it's all about computer chips.

E2: This is a paradigm shift, and there's no way to bridge that conceptual gap. It seems to me that AI is creating a paradigm shift. And if that's true, we're trying to use the language of the analog age to describe the post-digital age, which is ridiculous. But we have nothing else; we don't even know what AI really means.

E2: Just like when the first people saw electricity, they had no concept of how it would transform the world.

Niklas Mauer: Yeah, totally agree on that point. The pace of technological evolution is so high, and the future outcomes are unpredictable.

E2: It's indeed unpredictable. It's also uncontrolled. Currently, fewer than 2,000 people worldwide are on the cutting edge of this technology. They're doing things because they can, like a child with matches. They can do all sorts of things, but the long-term consequences might be destructive. This technology is changing our world, and it's managed by institutions, universities, research centers, or corporations.

E2: But here's where it gets political and philosophical, and it's my personal opinion. Can we trust big corporations to do the right thing? I don't think we can. Look at what they've done in finance, oil, medicine, or food. It's all messed up because they prioritize profit.

Niklas Mauer: This is...

E2: ...part of a larger issue, and it's pretty alarming. It's doubtful that big global corporate organizations have humanity's best interests at heart.

E2: It comes down to profitability in the end.

E2: And so, no, there's other people who just really say no, no, no, these people, you know, they are able to trust. You know we can trust them so. So the thing about it is this trust we don't. The answer is we don't know. We don't even know what AI means. I mean we don't, I mean we we're using it without understanding what it means. For example, you said that there's been no. There's been no real sort of usages of AI. There's been lots and lots of users of AI, but AI is very, very, very good if you know what you want to do. If you want to study the formation of viruses, AI is brilliant.

E2: It's brilliant if you want to take one million faces and find a face in the million faces. It's brilliant. So if it is task-orientated and it comes to data management at levels that conceptually as humans we have no understanding of, then it's really good. The problem is so.

Niklas Mauer: You're kind of kind of also need to translate it always into a mathematical problem statement and build an algorithm around it. And, as you said, it needs to be task-oriented. So would you also say that for each task in crisis management, we would need a suitable solution?

E2: No, because crisis management is not about solutions. Using the word "solution" for crisis management is a category error. You don't have a solution to crises; you have outcomes, maybe, but you don't have a solution. We don't have a solution to a pandemic, poverty, or global warming. So, conceptually, we're trying to impose a mechanistic understanding on it. There's nothing wrong with that; it's about the hypothesis, the problem, the check, and learning and

improvement. It's okay when you have a mechanistic understanding, but to do that, you need to model the problem first. The challenge is...

E2: It's different with wicked problems. Have you heard of wicked problems?

Niklas Mauer: Isn't it similar to complex, hard choices where you have...

E2: It's more than just hard choices; it goes beyond that. You need to understand wicked problems and non-rational issues. These are problems that can't be rationalized, like poverty or global warming. It's not about defining problems but understanding their complexity.

E2: If you bring that mechanistic idea to it, the response is engineering. You engineer a solution when you understand the problem and desired outcome, like building a bridge, car, or shopping trolley. However, this isn't engineering; it's ecology, biology, and life. It's about the dynamic dance of life, creating new life forms. That shifts your paradigm and changes your language and conceptualization. It's not just building a bridge; it's creating a jungle or the Arctic. This is planetary-level biology, not engineering.

E2: AI is being used in situations where it's too fast and too clever. Consider high-frequency trading platforms operating in milliseconds. They built new systems to save three milliseconds in data transmission. If things go wrong, it could collapse the global financial system in milliseconds. Complex systems combined with complex systems lead to almost certain failure, but the failure is unpredictable. We lack an understanding of what's happening.

E2: AI is evolving beyond our understanding, and governance hasn't kept pace. The head of Meta said it's not the time for governance, but that's precisely why you need governance structures—because you don't know enough about it. The challenge is that global organizations aren't good at fast, agile movement, and the rate of change is exponential.

Niklas Mauer: Governments are trying to put frameworks around AI, but they haven't reached a global consensus.

E2: Government officials may not be suited for discussing AI and global governance. They are often not well-equipped for understanding these complex issues, which need to be approached with agility.

Niklas Mauer: Fast pace and complexity make it difficult for traditional global governance structures to adapt to the changes in AI.

E2: Perhaps it's time to involve young people who are more attuned to the rapid developments in AI.

E2: Crisis management is not a rational problem. A genuine crisis is defined by a conceptual breakdown, a capability gap to understand what has happened, not just a big problem. It's not defined by the external event but the inability to comprehend it.

Niklas Mauer: You mentioned COVID. How does this apply to that context?

E2: In the case of COVID, the crisis was triggered by the question, "What the hell does this mean?" It's about a conceptual gap and the inability to understand the situation. I can share a presentation on this topic with you.

E2: Have you heard of Karl Weick's work on organizational behavior?

Niklas Mauer: I'm not familiar with it.

E2: Let me send you a link to it. Also, have you checked the ISRM library?

Niklas Mauer: Yes, I have. Could I get access or limited access to the resources there? They seem valuable for my research.

E2: I'll take care of that later. Yes, we'll sort it out for you. We have around 300 papers on this topic. Now, let's talk about recognition-primed decision making. When a crisis strikes, the first thing you want to do is make sense of it. You need to understand what's going on. How do you do that? By recognizing patterns. You look for patterns in the situation. These patterns help you comprehend the crisis. It's not the same as that, but it's somewhat like it. Let me give you a classic example. Imagine you know what a poodle is – a little dog, right? A poodle. If you're familiar with poodles, you can understand that a poodle is not an elephant. However, when it comes to systems thinking, there are common elements. Both have a body, four legs at each corner, mobility, a nose at one end, a tail at the other, and they eat food at one end and excrete waste at the other. In that sense, they are similar. They share certain fundamental characteristics. Now, if you understand what a poodle is, you can also understand what an elephant is. It's about conceptual understanding. When you see a Tyrannosaurus Rex, even though you've never seen one before, you can grasp the concept of what it is. You're able to recognize what it represents. This ability to recognize patterns is what's at the core of crisis management. In crisis management, you deal with situations that should, by definition, be unique. Each crisis is unique, and you should never face the same crisis twice. Take the example of COVID. There are two essential points here that align with what I've been saying. First, COVID as a medical issue is not a crisis. Even COVID as a pandemic is not the crisis. To illustrate, Ebola in Africa from 2013 to 2015 had a mortality rate of 50%, while COVID's mortality rate is only 1%. But the crisis lay in its global impact and the subsequent global lockdown. The real issue was the impact of a global lockdown. When you talk about a global lockdown, what does it actually mean? The truth is, we don't know. To highlight this, there's currently an ongoing review of the UK Government's response to COVID. They were utterly honest about it. There was no prepared plan, no capability, no responsibility, and no ownership. In essence, they had nothing in place. These people were admitting that they didn't know how to respond. However, if you look at countries in Southeast Asia, which had faced a coronavirus-type crisis in 2003 with the SARS outbreak, they recognized the potential of a similar crisis. They understood what COVID was and managed it differently.

E2: Let me explain the critical aspect in dealing with a crisis. Recognition-primed decision-making is the key. We aim to identify patterns. Although every crisis event is unique, we should never have a repeat crisis. Each one is distinct, but there exists a class of crises with shared commonalities. To prepare for future crises, we must grasp what these patterns look like and how to identify them.

Niklas Mauer: So would you say AI has a potential or already helps to understand these patterns and to predict better outcomes?

E2: Exactly, it does. AI has the potential to understand these patterns and enhance predictive capabilities. Let me illustrate with an example. Are you familiar with the DeepMind program and the Korean Go player, Lee Sujeong? In one of the games, during move 37, DeepMind's move seemed absurd, without meaning, a mere mistake. Yet, a hundred moves later, it became a game-changing move. AI can profoundly alter our conceptualization of problems, transcending human capabilities and imagination. AI takes us into uncharted waters.

E2: You know, the analogy is that humans are like swimmers staying close to the shore, but AI, it's like a deep-sea explorer delving into the profound depths of understanding. AI empowers us to investigate the previously inconceivable. It's akin to expecting a monkey to grasp intricate concepts like algorithms or galaxies. AI enables us to transcend the limits of our models and foresight, pushing the boundaries of our comprehension.

E2: What's fascinating is how AI guides us into the uncharted territories, the profound unknown.

Niklas Mauer: That's a valid point. I'd like to delve deeper with two questions. Given the range of crises we encounter, particularly those that fall within a class of crises, would you say there's no such thing as an entirely unprecedented, unforeseeable event?

E2: I'd appreciate it if you didn't use the term "Black Swan" around me. Even Nassim Taleb, the author of the book, has emphasized that the concept is widely misunderstood. A Black Swan isn't about not paying attention; it signifies a paradigm shift rather than a lack of readiness. People tend to label events as Black Swans when, in fact, they were foreseeable. Take COVID, for instance; it wasn't a Black Swan event. Pandemics were well-known issues. You get my point.

Niklas Mauer: So, are you suggesting that these events are like Black Swans, or do you believe they are simply unimaginable?

E2: I'd say these events are comparable to Black Swans, but not because they are unimaginable. Instead, it's because people weren't adequately prepared. Consider floods, fires, explosions, or even COVID. We should have been ready for them. On one side, you have Nassim Taleb's Black Swans, and on the other, you have...

E2: Have you ever come across Michelle Booker's book? She's a fantastic writer. Have you read my book? Oh, you haven't, have you? Well, you should because I discuss the concept of Black Swans versus Green Rhinos. Michelle Booker's perspective is intriguing. She argues that these are not Black Swans; they're more like black and gray rhinos. Picture a massive, intimidating rhinoceros right in front of you. You can't just pretend it doesn't exist.

E2: You know what I mean? These events could be conceptually likened to Black Swans. The possibility is always there. However, genuine Black Swan events, the ones that radically shift paradigms, are exceptionally rare. In 99.99% of the crisis situations we encounter, the root cause is our lack of readiness. We didn't allocate enough attention or resources. If we had been better prepared, it wouldn't have prevented the crisis, but we could have responded much more effectively. Take COVID, for example. I'd like to illustrate it with a specific example. Let me try sharing my screen.

E2: I apologize; it seems the screen sharing isn't cooperating. This is one of the reasons I have reservations about using teams. It's not always straightforward.

E2: Do you see that screen? That's the chart illustrating COVID, specifically COVID-related deaths. Take a look at the bottom line, where South Korea is positioned.

E2: The significant difference you see here is the outcome of a country with a well-practiced recognition and primed decision-making system compared to one without it. COVID affected South Korea similarly to the rest of the world, but their ability to engage with it effectively demonstrates that the course of COVID was not predetermined; other countries could have managed it better. This illustrates the power of recognition-primed decision-making and crisis management—it doesn't eliminate COVID, but it allows you to model it, engage with it, and manage it to some extent.

Niklas Mauer: I see your point. It's a matter of both organizations learning from past crises and drawing the right conclusions, as well as focusing on preparation for future events like this.

E2: Absolutely, because when we discuss crisis management and how to effectively deal with it, the counterpart to that is resilience. Resilience is a term often thrown around, but it's not merely about reacting after a crisis. It's more like getting in shape before a football match. You don't get fit the day before the game. You lead a lifestyle that keeps you fit. Similarly, if we aim to be resilient, we must, as you mentioned, prepare and establish the necessary foundations. It's not a quick, simple fix; it involves structuring society to be inherently resilient.

E2: It's not something you can solve overnight. It's about creating a society designed to be resilient.

Niklas Mauer: So, in other words, while AI can certainly assist in preparedness, ultimately, it heavily depends on the mindset and the societal factors—the human element.

E2: Absolutely, one of the things I often emphasize is that our problem isn't merely global warming. It's not a problem with global warming per se. Instead, it's a problem rooted in human greed and stupidity. If we approach the issue of global warming without addressing these underlying factors, we won't make real progress. COVID-19 demonstrated something remarkable. When the world entered a global lockdown, within about three days, the planet began to heal itself. Pollution levels dropped, rivers improved, and butterflies returned. It's a simple cause-and-effect.

E2: But what happened after the lockdown? We quickly reverted to our old ways, driven by human greed and stupidity. And here's the concern: if we don't address these human aspects, they will influence and control AI just like they have everything else. This will lead to increased polarization, alienation, and radicalization. A smaller group will control an ever-growing share of resources, while a larger group becomes increasingly disempowered.

Niklas Mauer: So, what would your recommendation be regarding the governance and regulation of AI? It seems that government involvement is necessary.

E2: I believe that we need to engage in a mature and thoughtful dialogue, much like what you're doing. Academic voices must be heard, aiming for influence, impact, and legacy. This is what

you, personally, are striving for, Niklas. The goal is to make your voice resonate with policymakers and practitioners, creating a lasting impact on our communities.

E2: Referring back to Rittel and Webber's 1973 paper on wicked problems, tackling issues like COVID is not about determining right or wrong, as no one has a definitive answer. It's not a matter of good or bad either.

E2: The crucial question is, "Is it useful?" Does it enhance our understanding of the world and our ability to model it? This is where your efforts become important, as you bring a perspective that adds value to the conversation and aids in comprehending the modeling process.

Niklas Mauer: Absolutely, we strive to encompass a wide range of perspectives. We conduct interviews with individuals from academia, government organizations, businesses, and other fields to align expectations with real-world experiences. I understand you're also involved in similar efforts with your conference and the State of AI in Risk Management. Could you share some insights into the opportunities and challenges AI faces in risk management?

E2: The opportunity lies in AI's capacity to process vast amounts of data and derive a coherent understanding from it. Take weather patterns, for instance. AI enhances the prediction of immediate, medium-term, and long-term weather patterns. An excellent application is in the Alps, where mountain search and rescue teams employ AI to forecast search locations after avalanches.

E2: For instance, if you were in the vicinity when the avalanche occurred, we can optimize our resources and focus our search efforts in a specific area. This is where AI truly shines.

Niklas Mauer: I see.

E2: AI's brilliance is in simplifying complex tasks. The primary challenges, on the other hand, are rooted in the age-old human struggles with greed and shortsightedness. We must ensure that AI is harnessed for the greater good, as we've already witnessed instances, particularly in China, where AI has been employed as a tool of oppression and control.

E2: I believe the likelihood is that people will quickly perceive AI as more of an oppressive and suppressive tool rather than an enabling and empowering one.

Niklas Mauer: It's getting out of control, especially with social scoring. When AI is combined with face recognition, it can have detrimental effects, and actions are taken based on that information.

E2: They're already using AI to predict people's long-term health prospects from birth, even identifying risks of certain diseases. Consequently, they start making decisions based on these predictions. It goes as far as anticipating criminal behavior.

E2: These developments are surpassing our ability to comprehend and model, ultimately raising the question: Do you trust humanity? Personally, I trust individual humans, but I have reservations about humanity's overall capability in risk management.

Niklas Mauer: So, to put it into context, you would say the issue isn't solely about trusting AI or addressing AI liability; it's more about the human element and how AI is implemented and governed.

E2: Absolutely, you've got it right. I'll take one more question, Niklas. Then I'll have to go. I hope this has been helpful to you, but I need to start preparing to leave.

Niklas Mauer: It's been incredibly useful. How do you think AI can be harnessed, not just for crisis situations, but also for addressing significant challenges and improving decision-making and communication?

E2: When it comes to communication, it's primarily an engineering challenge. Communication relies on engineering solutions. However, decision-making is more complex because it's inherently political. There's always a balance to strike. For example, New Zealand implemented an extremely strict lockdown to suppress the spread of COVID, which was their key performance indicator. However, it had severe economic consequences.

E2: They absolutely devastated their economy. In the UK, for instance, we never had a proper lockdown. The government was constantly changing their approach and vacillating. It always came down to making difficult decisions. Is it about suppressing the spread of COVID, preserving the economy, ensuring children's education, addressing mental health, dealing with domestic violence, or maintaining freedom of movement? These are human judgments.

E2: AI can provide valuable information, but it can't make decisions for you. During the COVID crisis, the UK government claimed they would "follow the science," but science doesn't dictate actions. It provides information. Ultimately, decisions are made by humans. This is where AI faces challenges because, as we discuss algorithms, they are created by humans and can carry inherent biases.

E2: We've observed that in AI, particularly in language generation programs, biases emerge rapidly, including language bias, cultural bias, and racial biases. The notion that these AI systems make neutral decisions solely based on data is not true. Biases are ingrained in them, and as we grant them more power, these biases become more influential.

E2: These biases tend to favor those who are already empowered while further disempowering those who are already marginalized. The biases aren't designed to benefit poor or disempowered people; instead, they favor the wealthy and influential.

Niklas Mauer: So, this could be a significant risk of AI—exacerbating social inequality even further. Many people who are already struggling may not have the means to harness technology, and AI may act against their interests due to these embedded biases.

E2: Exactly. It's not just a matter of using technology; it's about how the technology may work against them due to the biases within it. For example, AI could decide to sacrifice the favelas to save the people living on the mountaintop, based on the values it has already absorbed or the models it has constructed.

E2: These biases are inherently embedded, and if you examine previous government policies that have disempowered the poor and enriched the wealthy, you'll see that simply continuing

down that path won't work. Unfortunately, I have to go, but one more question, and then we wrap up.

Niklas Mauer: Could you please summarize the next steps or potential next steps? It would be fantastic if you could grant me access to channels that provide valuable information. I'll certainly do my homework and delve into your book and explore more about Carl Weis.

E2: Excellent. Don't forget to check out Carl Weis and Wicked Problems by Rittel and Webber. I'll send you a link. Keep in mind that your expertise should not only focus on AI but also on crisis management, particularly in the context of the 2020s. We are experiencing a paradigm shift, and you need to be prepared for it; otherwise, your conclusions might be misguided.

Niklas Mauer: Yeah, it's quite challenging to engage with these experts, and teaming up with you was certainly helpful. Ideally, having both parties at the table for a comprehensive discussion would be the most productive approach. Playing back and forth like ping pong can waste time and valuable information.

E2: I have to run. Niklas, it's been a pleasure. Thank you for the conversation. If you need any further assistance or if you'd like me to speak with your team, just give me a shout. I'm here to support you.

Niklas Mauer: Absolutely, I'll reach out. Access to those channels for travels would be incredibly valuable. Looking forward to the conference and our future discussions. Thanks a lot. Goodbye.

E2: Thank you very much. Cheers.

Description of interview situation:

Location: Online

Interview recording: Microsoft Teams conference recording was used to secure the data. Thanks to a quiet environment, high-quality audio files could be generated here. These can be accessed via the following link:

Short description of the atmosphere

Duration of Interview: 43min

Feedback:

Appendix 5.3: Expert 3

Transcript for the expert interview

About the master thesis "*Artificial intelligence in crisis management - an analysis of potentials and limitations to enhance top management responses as part of business resilience.*"

Name: E3

Company: Anonymous

Position: Professor of Law, Co-Director of the Centre for AI and Digital Ethics

Email address: Anonymous

Interviewer: Niklas Mauer

Date: 07.11.2023

Interview Objective:

This survey aims to facilitate dialogue among crisis management, AI experts, and Nova SBE students. In doing so, an exchange of information will take place that targets the topic of "Artificial intelligence in crisis management."

Niklas Mauer: Hey Jeannie, now that everything is working smoothly, let's dive right in. I know you have considerable expertise in artificial intelligence. Have you had any prior experience with crisis management as well?

E3: I've attended seminars where crisis management has been discussed. I work in a center for AI and digital ethics, so there's a lot of interest in using AI for public crises, especially environmental disasters. We've participated in seminars on these topics, but I don't conduct research in that field.

Niklas Mauer: That's great. It would be fantastic if you could share some insights from those seminars or your experiences. I'd like to structure our expert interview to focus more on the AI aspect, particularly the ethical considerations.

E3: Sure, that works. I've come across projects involving AI in predicting the paths of bushfires and estimating typhoon damage. For instance, there's a project in the Philippines that uses AI to predict vulnerable flood sites during typhoons. Additionally, there's ongoing AI work related to bushfires in Australia that I'm aware of.

01:39 Niklas Mauer: Using these use cases, can you elaborate on how AI might aid in crisis management? You mentioned prediction. Do you see potential for AI to contribute to decision-making, communication, and organizational learning in the aftermath of such events?

E3: Yes, in Australia, there's been significant work on bushfires. They're actively using AI to predict areas susceptible to bushfires and also to forecast the real-time path of bushfires for evacuation purposes during the preparation phase.

Niklas Mauer: So you would they it's relevant in the prediction phase?

E3: No, it's relevant during the decision-making phase as well. Bushfires in Australia, or wildfires similar to those in North America, can spread rapidly and unpredictably. So AI aids

in real-time decision-making, predicting the path of fires that are currently active and notifying people where to go.

Niklas Mauer: It's real-time decision-making because it's predicting the pathways of ongoing fires. This approach seems very interesting, and I assume you can learn from patterns and decisions made during the crisis, which can inform organizational learning afterward.

E3: Yes, exactly. They've mapped the vegetation and used that data to predict the burning speed of the vegetation, enabling them to forecast the path of any fire in the area.

Niklas Mauer: So, beyond what we've discussed, have you encountered any other use cases for decision-making with AI? Are there advantages and disadvantages to using AI in decision-making, especially concerning ethical aspects? For example, in flood management.

E3: Well, AI can be applied for crisis management purposes in advance. There's a system called Spark developed by the CSIRO that can be beneficial. It's something I've come across, and it's quite impressive.

Niklas Mauer: It sounds similar to what they're trying to achieve with Typhoon flood monitoring, which I've also encountered. So, do you see any issues related to the ethical considerations or other general challenges with AI that could pose limitations or disadvantages?

E3: Well, I largely see it as a positive addition. However, in terms of disadvantages, it's essential to maintain a human in the loop, or a human decision maker, because the technology is still relatively new and may not always be as accurate as desired. Therefore, human decision makers are crucial to apply their expertise and judgment, especially because the technology is still in its early stages. The first issue is the uncertainty about its robustness, so human decision makers are necessary to complement its limitations.

Niklas Mauer: So it's more about augmenting skills rather than replacing human expertise at this point. And I suppose it's also about building trust in the technology.

E3: Yes, people can still be suspicious of the technology, so trust-building is essential. Another issue I've observed, not just related to Spark, but in general, is an equity concern. Wealthier countries like Australia have access to satellite technologies, which is beneficial for gathering data and training AI. However, poorer countries like the Philippines may struggle to access the necessary satellite imagery for training such technology. One of the significant ethical issues here is inequality, where richer countries can afford to build such infrastructure, while poorer countries face barriers in accessing it.

Niklas Mauer: In addition to that, I've had other expert interviews where they mentioned potential liability or responsibility issues. Do you see these concerns as well? Or do you think that AI could address and resolve these liability issues in the future?

E3: Well, as a lawyer, I can say that liability only arises if there is negligence, and it's not determined by the technology being used. In this context, I believe the legal liability issues are not particularly difficult to solve. It's often mentioned that AI is complex and opaque.

Niklas Mauer: How do you generally address liability issues, then?

E3: AI actually manages liability issues quite well. If something goes wrong, the law is generally well-equipped to allocate liability because AI is a tool, and the person using the tool carries the liability. The question here is whether you have a strict liability regime or a fault-based regime, and that's relatively straightforward within the legal context. The bigger issue is in testing the technology. Before we fully rely on AI for disaster management, we must ensure that it is accurate and robust. To achieve that, we need expertise to oversee and test it. The real risk lies in having insufficient expertise for this oversight, as we don't want to entrust disaster management to unreliable technology. It's a matter of design and oversight. So it's more about the robustness and trustworthiness of the tool, and whether the people using it are confident and reliable. There needs to be a connection between the tool, the users, and their confidence in using it. Overcoming this issue involves ensuring that the people who test and monitor the tool have the necessary expertise. When using an AI tool, you need to be careful during the design process and have people with expertise oversee and test the outputs to ensure it's performing as expected. A governance framework should sit above the tool, and those in charge of that framework should have the required expertise. In essence, the liability issue comes at the end, and it's best to avoid it by ensuring the tool is accurate and robust from the beginning. This requires a strong governance framework and competent oversight.

Niklas Mauer: So, you also see some issues on one hand, and you're saying you need to bring the experts together from both the crisis management and AI fields, which, at least from my experience so far, hasn't happened much.

E3: Yes, I think that's right. You need expertise from both paths, and the crisis management experts should be involved in designing the tool to ensure it suits their needs and that their expertise is present to ensure it functions as required. You're correct; I agree. On the other hand, you have the issue...

Niklas Mauer: Would you say that, at the moment, bias is also somewhat of an issue?

E3: Concerns about bias typically arise from bias in the training data, but in crisis management, you could see bias in decisions. Bias usually involves treating people differently without valid justification and proportionate reasoning. In the context of crisis management tools that make decisions about protection and evacuations, there might be a risk of prioritizing richer neighborhoods. There have been instances, like in the New Orleans floods in the US, where wealthier neighborhoods received better protection than poorer ones. So, yes, it's something to watch out for. In this context, addressing such bias is more straightforward compared to biases in hiring or credit algorithms, where the set of factors being considered is more complex.

Niklas Mauer: So, what you're saying is that there could be some potential for bias, but currently, the people in charge are more likely to introduce bias than you would have with an AI tool.

E3: No, that's not precisely what I'm saying. I'm suggesting that bias might stem from historical patterns of who gets protected and who doesn't. For example, in fire or flood management plans, if you train an AI on historical data related to how authorities responded to such events, it's possible that bias could emerge, favoring richer neighborhoods over poorer ones or urban areas over rural ones. So yes, bias could exist in the data. However, it's probably easier to identify

and rectify this type of bias because it's based on geographical patterns that can be tracked and adjusted for. Bias based on personal attributes is more challenging to mitigate.

Niklas Mauer: Okay, I understand. So it's crucial to ensure the training data is accurate and to address any potential issues in the training data. Is there anything else that you think is essential to consider when developing AI for crisis management?

E3: Yes, it's important to be aware of bias in the training data. Besides that, you have the training data, then the testing data, and ultimately, the performance. During testing, you must carefully examine patterns that aren't justified by disaster response data but instead align along undesirable lines. So, vigilance is required for both the training and testing data.

Niklas Mauer: As we're discussing technical aspects, have you heard of Black Swan events?

E3: Yes, I'm familiar with Black Swan events. Predicting Black Swan events with AI can be challenging due to limited training data. However, with enough data, AI might uncover patterns that elude human observation. It's possible that, with sufficient data and advanced AI, predicting Black Swan events could become more feasible. What's certain is that human expertise and AI can complement each other.

Niklas Mauer: Combining both approaches gives you a better chance of predicting these events compared to using just one.

E3: With sufficient data, your predictions become more precise and potentially more accurate. However, the optimal approach is to combine AI with human expertise, not to replace humans but to enhance their capabilities.

Niklas Mauer: So it's about collaboration, utilizing the strengths of both humans and AI, especially benefiting from the emotional intelligence and multi-factorial decision-making abilities of humans in crisis management.

E3: Absolutely. Humans possess intuition and the ability to make complex multi-factorial decisions. AI can complement this by either supporting or challenging human intuition based on its results. It's the collaboration between humans and AI that yields the best results, rather than replacing one with the other.

Niklas Mauer: I've also come across the idea that AI may struggle with hard choices, situations where the outcomes are similar, creating a moral dilemma where AI can't provide clear recommendations.

E3: It's like the classic trolley problem. You can imagine AI facing a moral dilemma like whether to save three children or one grandmother in a disaster scenario. In such cases, human judgment is essential, and it's not something you'd want to leave to an automated system.

Niklas Mauer: Building on our earlier discussion about the different phases of crisis management, do you think AI could have applications in crisis response, such as shareholder management, communication, and performance tracking? Do you see potential for AI in these aspects of crisis response?

E3: Yes, you're referring to the potential use of AI in communications and predictions. While there might be potential, I'm a bit concerned about relying on AI, especially in the heat of the moment during a crisis. Generative AI, for example, may lack the accuracy needed for effective communication in such situations. I feel more confident in using AI for predictions rather than for real-time crisis communications due to current accuracy limitations.

Niklas Mauer: I understand your concerns. It might be possible to have a collaborative approach, where humans provide input, generate text, and then review and refine the AI-generated content as it evolves.

E3: Using AI during a crisis raises questions. While I employ various AI tools to enhance my writing, I'm unsure about its use in a crisis, as I wouldn't want to be experimenting with it during such times. However, one potential application could be for translation, addressing the challenge of diverse language communities in Australia and ensuring that information reaches the right populations.

Niklas Mauer: That's an interesting use case we haven't discussed previously.

E3: During the COVID outbreak in Australia, we faced difficulties in providing accurate information to small language groups due to a lack of translators. AI could be valuable in producing nuanced and accurate information in multiple languages, which could address this issue effectively.

Niklas Mauer: Great to hear that. Have you also come across any potential for utilizing AI in project management to efficiently allocate tasks during a crisis situation?

E3: In a crisis, time is limited, and intuition plays a significant role. While AI can be valuable in areas like supply chain logistics, it might not be as suitable for managing tasks efficiently during a crisis.

Niklas Mauer: That's interesting. Now, shifting our focus back to the human aspect, what do you consider to be the most essential skills where humans excel over AI, particularly in the context of crisis management or more broadly?

E3: My preference is for humans and AI to collaborate. The challenge with AI currently is its potential for errors. Generative AI can produce inaccurate or hallucinatory content, and predictive models might lack accuracy when dealing with data beyond their training sets. In critical situations, it's crucial to complement AI with human expertise.

Niklas Mauer: Absolutely, especially when the stakes are high. Can you provide a specific example of how this collaboration between humans and AI could be effectively applied or a potential scenario where it would be beneficial?

E3: The Spark bushfire prediction tool, for instance, is valuable for predicting bushfire movements. However, as of now, it's the humans on the ground who are responsible for issuing directives. They possess insights into local conditions necessary for making decisions. Bushfires are highly unpredictable, and those present at the scene may have a better understanding of the situation. For example, during a recent bushfire in Queensland, Australia, a human decision-maker realized that issuing an evacuation order, despite the approaching fire, would lead to gridlock on the roads, and people wouldn't escape in time. They chose to cancel

the evacuation order and directed residents to stay in their homes to fight the bushfire. This illustrates that although predictive information is crucial, decisions in the heat of a crisis often require situational awareness that AI may not possess, like understanding that cars could get stuck on the road. Therefore, AI should provide information that needs verification or complementing by humans present on-site. Currently, AI excels in data-driven predictions but falls short in complex, rapidly changing scenarios. In such situations, human expertise remains vital. And human judgment and context matter greatly in crisis management. It's a powerful example of how AI can support but not replace human decision-makers in dynamic environments.

Niklas Mauer: Thanks for sharing that. As we were discussing government and public issues, have you also come across business-related challenges in crisis management?

E3: Not really, because here in Australia, it's still relatively new, as it is worldwide. It's primarily government-funded, so the corporate aspect is not as prominent.

Niklas Mauer: Given your legal background, do you foresee any additional challenges that we may need to address or that are currently emerging due to the use of AI in crisis management? Or do you feel that significant progress is already underway in this regard?

E3: I believe it's crucial, as I mentioned earlier, to establish the right safety frameworks. These frameworks ensure that AI is not deployed without undergoing proper safety and accuracy testing. Addressing equity issues is equally important, and finally, involving human experts in the training and deployment process. This comprehensive approach is what I would call an AI assurance framework, from the initial design stages to field deployment, with ongoing reviews and testing. AI should only be released when we are confident it works effectively.

Niklas Mauer: Thanks for sharing your insights. Regarding privacy concerns, do you also foresee potential privacy issues arising from AI and data collection?

E3: In the context of natural disasters in Australia, there are probably fewer privacy concerns. I guess if you were dealing with counter-terrorism management, the privacy concerns would be higher.

Niklas Mauer: I believe these were the most relevant questions, at least for me when it comes to addressing experts in AI. Is there anything else you'd like to add or feel should be mentioned?

E3: No, I think those were good questions. It was great talking to you. Good luck with everything.

Niklas Mauer: Thank you. If I didn't receive the recording, could you please send it over?

E3: I'll make sure to send it to you since I'll have the recording. It might take a little time to download, but I'll get it to you.

Niklas Mauer: Perfect. Thank you. It was a pleasure. Alright, take care. Enjoy the rest of your day. Goodbye.

E3: You too. See you and have a great day. Nice making contact. Goodbye.

Description of interview situation:

Location: Online

Interview recording: Microsoft Teams conference recording was used to secure the data. Thanks to a quiet environment, high-quality audio files could be generated here. These can be accessed via the following link:

Short description of the atmosphere

Duration of Interview: 43min

Feedback:

Appendix 5.4: Expert 4

Transcript for the expert interview

About the master thesis "*Artificial intelligence in crisis management - an analysis of potentials and limitations to enhance top management responses as part of business resilience.*"

Name: E4

Company: Anonymous

Position: Director (Lecturer)

Email address: Anonymous

Interviewer: Sinah Janssen

Date: Nov 6, 2023

Interview Objective:

This survey aims to facilitate dialogue among crisis management, AI experts, and Nova SBE students. In doing so, an exchange of information will take place that targets the topic of "Artificial intelligence in crisis management."

Transcript:

Transcript

Sinah Janssen: All right. Sorry, I hope it's better now.

E4: Yes, I think it is better. Yeah. What did you do?

Sinah Janssen: OK, I switched to my mobile phone so I'm not connected to the Wi-Fi anymore because sometimes reference it low. So but I think now should work.

E4: OK, alright, let's give it a go.

Sinah Janssen: OK, perfect. Maybe before we start and. Let me just briefly. Show you. Umm. So. I hope you can see my my screen.

E4: One moment I cannot see your screen, no.

Sinah Janssen: Let's.

E4: You should be able to. There's a button to share screen and then you have to select the window or the screen that you want to share.

Sinah Janssen: Yeah, actually it should work now. Which will need says chewing, but it doesn't.

OK. Maybe then? Anyway, I'm I'm just quickly summarize it for you. Or I just draft the, umm, a picture into the into the chat? Umm. So, because OK, umm, we were thinking of about dividing crisis management into the three phases of pre, mid and post crisis management. So that being said, we also have the subcategories of detection and preparation, organizational learning and performance management, including communications. And last, the organizational learning. So that means if we are now talking about these questions related to crisis management, you can always like relate back to these to these faces, umm, so I just sent you a picture of it.

E4: Yeah, that I can see something's come through in the chat. One moment. Let's just see if I can see the picture. OK, very good. Let me actually try and. Actually want to just try and keep the picture up? Well, how can I do that? OK, copy image. Give me a second here and I'm just gonna put it on another screen. Spine. Yeah. OK. Yeah, cool. Got it, alright.

Sinah Janssen: OK. Alright, perfect. So as I said, we are trying to divide crisis management with introduce phases. So any question that's basically related to access management that we will not talk about, you can always slide for back to this picture. So because as you said, you might not have like a direct touch point, but we are looking at these subcategories. So yeah, just just so you know. And yeah, you'll have to answer these questions very if you're comfortable with or where you think you like some nice insights. Yeah. And I think if you're ready, we can then start. OK. OK, perfect.

Sinah Janssen: So umm really? Just for the quick quick introduction, you could just explain your background. The company you're working for, which touchpoints you might have with artificial intelligence within your field. Umm. And then yeah, I'd probably just wrote first of all back to you.

E4: And so background. Uh, I have a long history as a consultant. UM, 23 years of Accenture, five years independently, and now I'm at Anonymous . We and my role at Anonymous is not actually directly as a consultant. It's more from a research and thought leadership development perspective. UM, in addition to the Anonymous role, I also teach at Nova and that's how your colleague got my name. And so I'm teaching strategy and decision science at at Nova and in terms of artificial intelligence. Well, I I wouldn't say I've got the huge amount of experience, but I I am bumping into artificial intelligence in a couple of ways. One from a research perspective, because the thought leadership we're doing obviously needs to be current and addressing the kinds of issues that management are currently facing. 04:42 E4: And so artificial intelligence pops up there. And then secondly, uh, in my own research, I'm starting to or I am using tools like like chat, GPT and and BOT and Bing and so forth and so I've got something of a let's say a user experience in using at least the gender AI tools and then I guess I've got. Something of a. Uh, but it would be a little bit too strong to say a developer experience. I mean, I'm doing quite a lot of sort of empirical analysis work, so we building statistical models and that the you know ultimately these artificial intelligence or machine learning things are just statistical models. So I've got a little bit of the kind of inner workings exposure as well.

Sinah Janssen: OK, to thank you very much. Umm, so when you were talking about these statistical intelligence tools, are you using them directly? Like if you're talking about your research here, then using them directly regarding to to decision making a performance management. So instead of like something like a use case, you could probably share with us. More specifically.

E4: Well, umm, OK, so let's see. The kind of use case that you're looking for, maybe just characterize and so I can describe whichever experience I've had that's most relevant. What? What would be the ideal use case that you're looking for type of use case?

Sinah Janssen: Like for example type of use case. If I'm thinking about decision making, you have like for example we have comprehensive search. So first of all, you want to understand the topic or the problem that arises within the crisis. You then making a decision about and. I just think that that that this is again just a hypothesis for now that you might like can use AI in order to sort this data and to understand the data. And then, of course, it might also help you to like, prioritize, privatize, or true the consequences.

E4: So I've done a lot of work in decision making. Umm I have not used AI in decision making at this point. Am I in fact, at the end of this week I'm attending a conference on exactly that point on AI in decision making. And so I'm. I'm in novice in that space. I don't really know how AI, but kind of kind of have some idea conceptually, but I I I don't have any working experience of that. So the decision making that I've worked with that certainly has included statistically statistical modeling, but not AI.

E4: So in other words, trying to understand uncertainty statistically and trying to determine for different paths forward different strategic alternatives, UM, like in taking uncertainty into consideration, which of those has the best prospects? So I've done quite a lot of work in in that respect, and arguably. You know, I would do something like that, but just, you know, massively more powerful, powerful than the way that we doing it, just modeling a few variables. I mean, AI would model, you know, thousands, if not millions, if not billions of variables to to do an exercise like that. So. So I guess the point is do I if if you asking me do I see AI as being relevant to assisting in the decision making process and then yes, I absolutely do.

E4: And exactly how and with my own experience, I can't comment on that yet. Does it? How does it pertain to crisis management? Well, I I think it's a very important aspect of crisis management and I don't know anything about crisis management other than the fact that that, that these are typically new events.

E4: These are things that we don't necessarily have good experience for, right? Pandemic strikes. There's a terrorist attack, whatever supply chain, geopolitical disruption in the Middle East or in with China or whatever. And so now we are trying to do things in a way that we haven't done before. And when we're trying to do things that we haven't done before, I'm we have a big problem in in decision making in general. And and I would say in AI as well is that we don't have the knowledge base of data to call on because if you if you're trying to do something that that has been done before repetitively, then you can get a machine to learn how to do that and you can optimize how that's being done.

E4: But if you're trying to tackle something that's novel, it's much more complicated. And I would imagine that crisis management would fall into into that situation. Does that make sense?

Sinah Janssen: Yeah, that makes a lot of sense. Thank you very much. Umm. So maybe then or so like referring back to that. So thinking a bit deeper into it, you were just talking about where

we might have, like, limitations, just water from the from the human side as well. What other limitations would you probably see? Like I know that you might have like need some certain skills in order to if you have like if you have made a decision of obviously people you need to have the authority and so on. So maybe you can also liberate on that more.

E4: What limitations do managers face when, when, when tackling a crisis? Is that the question and and? OK.

Sinah Janssen: Where you won't probably say, OK, well, that's like something that that way where when you you would think that humans are more eligible to rather than an AI.

E4: Yeah. Look, so I think that I think that people face limitations and I think machines face limitations when. What? When it what facing complex decisions? Uh. Particularly under time pressure, so crisis management typically would have a time pressure element to it, which makes it even more difficult to. Umm, you know to collect and carefully consider the data because one has to act very fast. So the first limitation is not enough time to to be considered. In one response, I would say for the machine as well As for the people, the second limitation would be what I previously mentioned, which is not having a knowledge base to draw on to make inferences, and that is true again for both the machine and for the person.

E4: The there's a that particular problem is more of a problem for the person than than for the machine, I think, and the reason for that is that the person might think that they that they know how to respond, they they they might think that the intuition is reliable in that setting. But the research shows that our intuition is only reliable when we have what's called a high validity environment, an environment that we can learn from, and that is a applicable to the environment that we currently face.

E4: And the problem is if if it is a novel crisis and almost always I think it would be a novel crisis, I think because if it wasn't novel, if it's something that the company or organization expects to encounter, then it probably would have already put things in place and it wouldn't be a crisis. It would rather just be a different type of response, so if it is a novel crisis, we might believe that our intuition can help guide us through this, but our intuition is unreliable in this context, and that's a massive human failing that we all susceptible to. I'm and then in in.

E4: In addition to that and it's actually directly related because it's, it's sort of a compounding effect is that we as people are susceptible to all kinds of biases, overconfidence, bias, confirmation bias lost the version and framing effect availability, blah blah blah blah. Like hundreds of these things, umm. And these these biases. Are going to be present when we are responding in an intuitive way and we believe that we can respond in in an intuitive way, and even if we're not responding in an intuitive way, even if we were responding, we're trying to be considered, but we we haven't got the time and we haven't got the skills to to be, let's say, analytical about and considered about how to respond.

E4: And then we're still going to be susceptible to these biases. So our decision making as people is going to be distorted, undermined uh sub sub optimal I would say and the decision making of the machine is going to be because it doesn't have the right. And uh, the training data to to draw inferences from. Are there other limitations? Let me think. UM, well yes, another

limitation, I suppose is a. Is a deep psychological limitation, which is that when people, when people are put under this kind of pressure, then then sort of primal behaviors emerge, and so they might you, you might see, you know, behaviors driven by by fear or greed or or some bad behaviors.

E4: And you might see a lack of collaboration cooperation with others. You might see both authoritative or autocratic behaviors emerge. UM, so you might see some bad behaviors and and and. These are primal survival instincts that are, that are that are coming out potentially. And in other words, yeah, we again, it depends on how intense the situation is and how urgent the situation is. But so I'm referring to when someone feels that they're under under a degree of urgency, and maybe when they feel that their life, either their life or their livelihood, is being threatened by livelihood, I mean the ability to to form a longer term perspective, to take care of themselves and their family and friends.

E4: And so forth. But they're about to lose. They lose their business or lose a lot of money or something like that. Then then that's going to create some some primal responses. Which which can be negative to the situation as well. I'm other limitations. Yeah, maybe maybe you need to prompt me. I can't. I can't think right now of of other limitations.

Sinah Janssen: No, no, that's already very good. Umm. So maybe then just refer. You were already like mentioning that it might depend on the situation or how urgent it situation itself is. If you would like wait now and think about like where you would probably see the best of the most use cases for AI would be rather than in in scenarios that are more likely to have done with, you can probably protect more likely OK.

E4: Well, OK, so so. So here's the thing, I'm it. It might be a novel situation that you're facing. I'm. I mean, look, make. Let's make a simple example. Let's say the building is burning down and you've never been in the situation where you've been in about a burning boating before. However, hundreds of thousands of buildings have burned down somewhere, somewhere around the world. So you could train an AI with the data based on all of those buildings. So that's not a novel situation for the AI, but it's a novel situation for the for the individual or for the management, right.

E4: And you, you you could in theory, I guess, UM, hand over control to the AI because it has a a much richer I'm experience based that that it can draw on and and and and and and. So let's say that there's different things that you could do for buildings burning down, right? You could whatever try and put it out. You could try and evacuate everyone. You could try and do this. You could try and do that and and and and.

E4: Let's say that from the thousands of cases where buildings have burned down, we know what works better and what works worse, right? And so the AI could now have that knowledge, and it, and rather than a person trying to intuitively respond to, say, what's the right thing to do here, we we hand over control to the AI and say, OK, you've seen 1000 cases. We've seen none. You are better equipped to do this now. I think people will be very uncomfortable to hand over the controls to AI in a crisis situation.

E4: So one has to think about, well, how do you how do you kind of complement the AI with the humans at the end of the day? And so maybe it's, you know, maybe it's the the AI is able to process the data very quickly, make a recommendation but not execute the recommendation without the user's approval without the managers approval and and so and and maybe the AI can can serve up to can serve up to the manager.

E4: Well, from past experience, that's the AI's data set. Has this three whatever viable strategies that one can pursue, and this one has the highest probability of success and so therefore we recommend and present the data on all the cases and say that that in this situation these are the respective probabilities of success. I mean, you probably seen movies, right? Where? Where? Where where someone is kind of like running away from the bad guys and and there's they've got like a augmented reality headset and the and this thing is saying bad guys hiding here. But if you take this path, then you've got this chance.

E4: You know, you could get that sort of information that is, that is giving managers that and that that's sort of data driven insights that's that's usable, that's relevant, but ultimately that that the managers make decisions but they they are richly informed by the AI. I could see something like that being applied.

Sinah Janssen: OK. And could you see a scenario where AI takes over everything? Like basically without having a miniature to.

E4: Well, I mean, I think that's a I think that's a I think that's a choice that we make. I think you you could do that, but I think most people would not be comfortable with that. So the reason that when you get into an airplane these days, there's still a pilot sitting in a seat even though the machine is flying the plane for the most part, right. People just want the comfort that there's someone there that they can hear a human voice and not hear a machine talking to them. Right. And and that and feel comfortable with that. And that's if the **** hits the fan that you know that that person is there to maybe intervene, not necessarily that they could do better than what the machine could do at that point.

E4: So look, yeah, I think I it's the same with the resistance to driverless cars. I I think people initially and until the use case is so well better done, probably want to a person in the final point of control. They don't want it to be fully automated, but I think what the data will show is that leaving difficult situations to the choice of the machine is probably probably the best thing to do. But but people are uncomfortable with that yet. So, so so the answer is yes, you probably could leave it entirely to the machine.

E4: Although most people would prefer not to do it that way, and maybe in certain circumstances you want to for other reasons because because the data could only go so far, you want someone to exercise human judgment over and above the machine as well. But for two reasons. One because you feel comfortable with the person, but two because. Because they might be. Contextual information about the current situation, which is not part of the the the model that the machine is running, right? So they've been a few accidents with driverless cars

and and and contextual to the contextual information was typically somehow different, right to to. So the machine has been learned and there's a huge amount of like information.

E4: But but if the situation that that you find yourself in is somehow different, the machine has and and has no basis to to to make sense of that. That. That's where accidents can happen. So if there's novelty that the machine doesn't have, it just comes back to my first point. I'm supposed the machine needs to have had the experience of these things as well. Some crises they won't be a precedent for the machines. Some crises, there'll be a massive precedent for the machines, and most crises will be somewhere in between, where there's some level of precedent. But if the level of precedent is not complete and most cases, it wouldn't be complete, then bringing in a person in the final stage to make the ultimate decision, I think that makes sense.

E4: Does that make sense?

Sinah Janssen: Yeah, it does make sense. Alright. Umm, so I think you already also touched upon it. Through would you say that's main prod like ethical concerns? If you're like leaving it to a machine that people would probably feel most.

E4: Well, it's it's it's a perceived ethical concerns because the the ethical. So. So. So imagine imagine 22 scenarios. 11 scenario is where you leave it entirely to the machine. Another scenario is you leave it 90% of the machine and then the last 10% to to to people to make that final decision and that the success rates in the first where it's entirely with the machine are higher than in the second where it's 90% with the machine and the persons making the final chord because you are concerned ethically that the machine might do the wrong thing, but you've actually made an ethical fault.

E4: You've made an ethical error because you would have been better off leaving it to the machine entirely, right? If you imagine those two scenarios, which is not implausible, that there's a scenario where the machine will have a higher success rate than the machine plus the person. But but for ethical reasons, you feel that you want the person involved. But but but you make an ethical error if by having the person involved you, you're actually reducing your your, your levels of performance or levels of success. And so an example of that of course would be in in self driving cars again because and I mean, everyone knows that the safety record on self driving cars is is better than allowing people to drive.

E4: And then you say, well, what about a person in a self driving car with a person can make the final call? Well, that's not necessarily going to do better than the car. The car on it's own, but you might feel ethically it's the right thing to do. I just think that's ethical confusion here because ethically you want the best outcome, but you feel that having the person involved is going to improve your chances of an outcome. But that's a perception. That's not a reality. In some cases, in some cases it might be.

Sinah Janssen: OK. Thank you. And maybe like having like the take it on another perspective on it. So based on your experience, what would be skills that humans need in order to incorporate AI?

E4: What would be skills that humans need in order to incorporate AI?

Sinah Janssen: Yes, yes. Which requirements do you see for organizations should be there.

E4: Look, I I I think the first an important skill or or or or maybe not skill, but mindset right is is humility umm and the humility to accept that we are not always right and we are not always better as people that sometimes handing it to the machines is better and I think people really struggle with that right.

E4: There's this natural inclination that we believe that we're kind of that. We are always going, we always going to know more for good or be more ethical or or do better or something like that. Umm, but we fool ourselves. A lot of the time because we make lots of mistakes. Lots and lots and more senior people in organizations obviously make bigger mistakes because they're making bigger decisions, but they also more confident of their decision making and and and we see we see failure all around. We see failure in in missed opportunities that companies should pursue. We see failures and mistakes because companies did pursue things that went wrong.

E4: So, umm, so we see the bit you know the some of the biggest and most sophisticated companies in the world struggling to sustain their leadership position even though they've got the resources that they could have, they could apply to to being better than those smaller challenger organizations, but they're being they're being beaten.

E4: A lot of the time and and my personal point of view is they're being beaten because leadership doesn't have the intellectual humility to

recognize that they could be making decisions better and and making decisions better in today's world would mean handing over at least a big portion of those decision making to to artificial intelligence.

E4: But so. So for me, that's the number one, the number one. It's not a skill, but it's more of a mindset in terms of in terms of skills. I guess the skill the skill is or would be how to work collaboratively with machines. How to recognize the respective role of the machine and the person and how to do that in some sort of way where you know there's a synergy where where the the sum of the two is is more than what either of them of of the two could do individually. Umm, so that would be a skill.

E4: Maybe how? How to collaborate with the machine other skills? Umm. Well, I'm just looking at your model here from pre to mid to post crisis. There has to be a skill or organizational capability on this last point of organizational learning. Umm, I think that's so important that when things are happening umm, in normal times, in semi crisis times and in crisis times that that we're gathering the data in terms of what has happened and feeding it back and so that the detection and preparation is continuously being improved so that we can be more

alert to how things are unfolding because we've been deliberate about about about learning, collecting data and learning from that.

E4: So I think that's a maybe not a skill, but it kind of is. But it's a capability that the organization needs needs to vote and and. And I think in my experience, I think there's very little of that going on. People make big decisions. They never record their assumptions behind the decisions. They never track to know how those assumptions have been validated or invalidated as time has gone on and they've never, they don't seek to improve in a deliberate way from what's happened. So for me that's that's super important. I'm detection and preparation, yes, besides for picking up the learnings.

E4: I mean, there's probably more sophisticated tools that one could use. Again, that's more capabilities than skills. But no, I'm not. I'm not sure on the skills, skills front beyond that.

Sinah Janssen: OK. No, no. I think that was really good. Thank you. Umm. So let me just see because I think we touched upon the most topics. Umm. So yeah, maybe they're just like, is there anything else that you would like to to share? Is there any best practice or use case that you're still have in mind that we didn't touch upon?

E4: Umm. Well, it's not a direct answer to your question, but I think that, UM. We almost by definition we cannot predict the next crisis. Right. But we can predict that there will be future crises and so. Organizations would do well to have some level of. Preparation. Uh, in terms of what to do under different types of crises that might that might affect the organization, right? So uhm, I mean, I know that for a long time there's been things like business continuity planning, disaster recovery planning and stuff like that. Right. I don't, I don't know to to what extent that still. I mean, I remember this from 30 years ago. Organizations were building such plans.

E4: I don't know to what extent that's that's still something that's being done and and whether that has how that's being done, whether it's pervasive, if all organizations are doing it, how, how it's being done, whether it could be done in better ways. But for sure, what we can say is that. Like stuff gonna happen, we don't know what stuff, we don't know when, but stuff's gonna happen and we can probably categorize the stuff that's gonna happen into different broad categories. And we can probably have some level of preparation, you know, forewarned is forearmed if we know that we face whatever supply chain disruption or if we know that we face, umm, whatever work is inability to come into work for whatever reason.

E4: And well, if we know that we face such and such, what do we do under those situations? I think I think organizations could anticipate that those things are gonna happen and be properly prepared for those things. Even if they don't know the specific thing, nobody predicted the Israel-Palestine conflict and whatever ramifications that might have, right? No one predicted COVID no one predicted and and so on.

E4: We don't we it's very difficult to predict the specific instance of what's going to happen only to say that in the next year something else is gonna happen, right? An earthquake somewhere? A terrorist activity somewhere? A whatever, somewhere. So knowing that things are gonna happen, we just don't know what things we that that still gives us enough information

based on on sort of our history of types of things that types of things rather than specific things to do something sensible about that. And if we can include AI in how we how we scan the horizon, how we prepare, how we respond so much the better. Particularly in times of urgency where where people aren't thinking clearly and rationally.

Sinah Janssen: So then you would say, OK, maybe then just going back to the scenarios we have, like the more basic scenario or the invention scenario where you know like have a lot of information because it's something already happened, then you have these novel situations you just talked about it, but you would say that you still see use cases within both scenarios, all the in the one probably a little bit more than in the other one.

Sinah Janssen: But still would say that there's.

E4: So, so the novel novel, the novel novelty of the situation I'm makes it more difficult, as already mentioned, and it makes it particularly more difficult for people because we only have our own lives to draw on, right? Our own our own life experience to draw on, but in a world where we collecting lots of data and every day we collecting more data than before, right? And if that data if that data can be harvested and intelligently used, and it can be fed through it in the machines, then even if we face some unique crisis or some unique event or whatever, it's unique in in that that event hasn't happened at at that place at that time etcetera.

E4: But it also has commonality with other events. The common the commonality is as per some of the examples I mentioned. Is it's a supply chain disruption. It's A and it's a worker productivity impairment. It's a. It's a this or to that. And So what? What AI is good at is processing lots of data, understanding data at the class level rather than the individual case level, if that makes sense, right? And from that we can make some inferences. Umm but but, but that would require that the A and and and this is a practical limitation that would require that the the AI has access to that vast body of data. Now, in any particular organization, typically the AI only has only has access to I. I would say two types of data.

E4: It has access to the company's own data. The proprietary data of the company and to the wider public data set, right, the Internet or whatever. What? It doesn't have access to is every other company's proprietary data for obvious reasons, and so that limits the amount of the data set. I mean if I the simple example I gave over a fire in a building, all right, how many? How many such datasets are actually harvestable? Ingestible why AI. Probably very few. In theory, all of them could be right.

E4: In theory, we could be collecting data like that, but we're not currently set up to set up to do that, so therefore the AI is going to be limited by an inadequate data set, right? Probably for many types of situations that it faces and then then the AI and unreliable it is not data sufficiency for the AI to be properly trained. I'm. I'm saying in theory it could be, but in practice it probably won't be. Umm, so now we've got we put AI that's insufficient and we've got people that are inadequate. And then we've then we've got a real problem on our hands and.

E4: The the practical recommendation I would have is is that we've got umm as already mentioned, that we've we've we've anticipated that certain types of events will happen and we've

got certain types of responses to the to those events and that's probably the best we can do there. I don't know.

Sinah Janssen: Umm, alright, so probably is more novel events are might be like difficult for for data too.

E4: The the the more noble it is, the more difficult it is, yeah.

Sinah Janssen: Umm yeah, there are notes again for human now. All right. So thank you very much. I think just for some.

E4: Is there anything that is anything that I've said that is unclear or or if you'd like me to explain further?

Sinah Janssen: No, actually not really like I think this was only like the contradiction that I had in my mind regarding like the best novel and Nova situations. And then the use case, because obviously for humans it gets also more difficult. And regarding like how severe the situation is? Umm, but I think this was the last point. We didn't touch upon, and so from my side, umm, no, I I don't think so. So thank you very much. It is very clear and very, very used on sites. OK. OK. Thank you very much, and have a nice day.

E4: Alright. Thanks. Cheerio.

Appendix 5.5: Expert 5

Transcript for the expert interview

About the master thesis *"Artificial intelligence in crisis management - an analysis of potentials and limitations to enhance top management responses as part of business resilience."*

Name: E5

Company: Anonymous

Position: Senior Consultant - Crisis & Resilience

Email address: Anonymous

Interviewer: Niklas Mauer

Date: 31.10.2023

Interview Objective:

This survey aims to facilitate dialogue among crisis management, AI experts, and Nova SBE students. In doing so, an exchange of information will take place that targets the topic of "Artificial intelligence in crisis management."

Background for not using interview guidelines:

Hi Niklas,

Thanks for sharing your questions with me. Having reviewed them, I am unsure how I can add value to your research, and I'm afraid our call today may be a waste of your time.

I am a consultant to corporations needing crisis management training or planning. This also uses simulations/exercises or business continuity plans, but I am not involved in crisis response - only preparedness.

Generally, the companies I work with are pretty immature in their crisis preparedness, and AI is the last thing on their mind.

Having studied risk and disaster reduction, I only know of machine learning used for catastrophe modeling, which is usually only done by reinsurers.

Niklas Mauer: Hello Jacob, after you accepted the recording, I wanted to hear your definition of a crisis.

E5: Crisis is defined in simple terms, making it easier to deal with at work. We usually define a crisis as a sudden event with a high negative impact and a low or unpredictable outcome. Dealing with it is generally divided into three phases. First is the emergency or emergency response, which primarily involves health, safety, and fast on-the-ground response. This usually has escalation triggers for crisis management, which means instant response, mainly on a side level. These employees escalate this to top management, who handle the crisis as part of a task force, which falls under crisis response. The final step is business continuity. This is important because as soon as the crisis is managed, business disruption should also be migrated in the

future. This should be addressed as part of the business continuity plan, but the crisis is not always so big that it has to be escalated to crisis response.

Niklas Mauer: How is the distinction made here regarding whether escalation needs to occur, and what KPIs or case distinctions are here, such as the risk to human life?

E5: A company should always escalate as soon as human life is at risk, it should be escalated to the executive level and thus classified as a crisis. It should include legal, HR, and operations to deal with the business disruption, as both human and shareholder management and share prices play a significant role in crisis management. Communication plays a vital role here. In detail, it is essential to have already drawn up defined response plans for various scenarios.

Niklas Mauer: To what extent are the communication plans developed with the client, or to what extent is the consulting function carried out within the chain?

E5: The consulting approach covers all three sub-areas, from emergency response to business continuity plans. But it also includes crisis communications. Sometimes, we carry out exercises that focus entirely on crisis communications. An example here would be the execution of a ransomware attack based on a tabletop focusing on how internal and external communication takes place, with whom this communication takes place, and when it takes place without deterring shareholders. Here, trigger points/crisis triggers would also be coordinated.

Niklas Mauer: How are trigger points defined?

E5: The trigger points are very much tailored to the company and its risk appetite. Most trigger points are relevant in the emergency response plan and are primarily developed here. For example, as soon as a certain amount of time cannot be worked typically, as soon as a certain level of injury is exceeded, or as soon as media stories reach a specific size. This media monitoring could be supported by AI, for example.

Niklas Mauer: This area seems very broad, so a more specific question. Does Anonymous support tracking and prediction, and are there any approaches here? For example, cyber security? Is there any kind of threat monitoring?

E5: This is happening in the area of cyber monitoring. Here, highly specialized companies offer their products, such as CrowdStrike, which offers automated end-to-end monitoring. Escalation is then fully automatic to the relevant specialist departments or previously defined persons. Alternatively, you can also use social media or news monitoring. The focus here is primarily on keyword searches. Catastrophe modeling can be used for catastrophes. It is becoming increasingly sophisticated in this area. There is a lot of progress in AI, but not in the personal area. In the insurance industry, catastrophe modeling predicts the probability of certain natural disasters and calculates the insurance premium. This is much less common in the insurance industry. For consumers, it is primarily simple models. AI and specialized models are only for multimillion-dollar companies.

Niklas Mauer: How often are the models adjusted, and what is the degree of deviation?

E5: Generally speaking, there are products like RSM (the biggest provider of catastrophe models) where endless amounts of data from databases like ACLET are used. As these databases are so extensive and actual, they can most likely be used for AI predictions and run

decent models. The problem is that climate hazards are so frequent that models can predict them anymore. For example, the hurricane in the Caribbeans completely outperformed any model regarding how quickly it became servile.

Niklas Mauer: I have encountered similar issues where the quality of the data sets is not good enough for predictions anymore. Switch back a little back to the crisis management limitations. What are the vital skills and requirements for a good crisis management process and business continuity plan?

E5: The main element is laying out the policy or building the plan. The second piece is training the people to use the documents and process you have outlined and the culture around it. It is essential that people need to take the risk seriously and the subject matter, even if they don't believe that it is likely that a crisis will appear. In crisis management and business continuity, we don't think as much about risk and more about impact. That's because we don't speak too much about probabilities and more about how it will happen and that you need a plan for it based on its effects on the company. That's the key to preparedness, as you want them to be ready to respond.

Niklas Mauer: Just to clarify here. How is the training done? Do you focus on teaching them which documents to use or processes? What kind of tools do you use?

E5: By training, I mean primarily crisis management skills or skills based on their role. In my experience, people in crisis management are those in executive leadership who form the task force. Those people need to clearly know their roles and responsibilities during a crisis. This can be achieved by doing simulations, i.e., role planning, talking through a process, or accurate world simulations.

Niklas Mauer: So let me restate this. You are saying that the process steps must be subconscious in their minds, and therefore, you train on different crisis types.

E5: Yes, that's right. For example, Someone in communications would probably have their holding statements prepared for the different scenarios. If you are a company exposed to cyber attacks but also to terrorist attacks or social risk, you would have various separate holding statements ready and release them shortly after presenting them to the crisis management committee. In addition, it is also relevant to focus on internal communication and not only external as you would likely convince the crisis management team in a meeting, discuss the tasks of each member, break up to perform the tasks, and meet up again to coordinate again. There are a lot of iterations to it, and companies take many lessons from the public sector as crisis management is pretty sophisticated there.

Niklas Mauer: So what you are saying is with the holding statement, there is some potential to generate these statements as well as for project management and coordination, but more important is the human factor, especially for strategy formation and decision making.

E5: Yes, exactly. Especially in crisis management, it is essential to clarify liabilities. If it was, for example, a cyber crisis, the CEO could be held responsible for specific actions or actions he has not done and face fines as a company. If it is health and safety related and it comes out that not the right plans and procedures in places or operations in unsafe facilities, you can face a prison sentence. That's why the human factor is essential, as you cannot take out your responsibility at the top of the company.

Niklas Mauer: To put it the other way around. Would you say liability is an issue of AI?

E5: Yes, at least at this point, with the technology, crisis management is where AI is helpful. It can benefit preparedness, risk modeling (identify triggers), communication, and control. But not in the actual management of the crisis.

Niklas Mauer: That's insightful. Therefore, we want to elaborate on limitations and potentials. To go a little further. What could potential use cases for communication or performance measurement be? Is there a tracking of actions?

E5: Generally, we recommend a debrief and a post-incident review to capture the lessons learned, what went well, and what needs improvement, as crisis management is an ongoing cycle where you prepare, respond, recover, and review and then start again.

Niklas Mauer: As you mentioned the lessons learned, how do you readjust documents and training?

E5: Something that comes to my mind as we are talking. One issue that companies and functions generally face that are responsible for crisis management is that these are cost centers. Therefore, it is pretty difficult for them to get resources. AI could help with defining and quantifying the value of crises that have been averted. This is the thing in government where you never hear about the crises that have not happened or were avoided. In a business sense, it would show that good preparedness was done, and with some modeling, this value could be captured better.

Niklas Mauer: Definitely, it always comes down to the shareholder, and evaluating these would help the crisis management team to state their importance. Do you have further examples to measure the risk?

E5: I can see specific climate-related risks. You can measure that. A recent example we discussed at the company was how organizations that do TCFD climate disclosure, generally demanded by regulations, must do a certain amount of analysis. This is presented to auditing as a waste of time and money if these reports are not handed over to business continuity teams to see where the risk hotspots and revenue exposures are and how they could play out in the future. Then, you could use that to plan mitigation measures and argue the impact of revenue exposure and the money allocations.

Niklas Mauer: To summarize the interview a little, in crisis management, the human factor is critical, and AI can support some tasks, i.e., prediction and control, but due to the fast response and liability in decision-making and organizational learning, the human factor is dominant.

E5: Yes, that's quite a good summary where I would agree. Just to add, I personally haven't seen companies using AI in preparedness and planning yet, but I see high potential in the future. If you could find detailed use cases that would have a high value. In addition, I'm really interested in reading your work and seeing responses from other interviews, as this field has not been profoundly analyzed yet.

Niklas Mauer: Yes, as said in the beginning, we are happy to share this information anonymously so that you can also have value.

Description of interview situation: Academic research, knowledge transfer, and information gathering

Location: Online

Interview recording: Microsoft Teams conference recording was used to secure the data. Thanks to a quiet environment, high-quality audio files could be generated here. These can be accessed via the following link: https://novasbe365-my.sharepoint.com/:v:/g/personal/55574_novasbe_pt/EXj-1PJ8sqlAgXDgLMbn5NsBwLi2tFxqRFty3t6XsF5M5g

Short description of the atmosphere: Good atmosphere, on the same level

Duration of Interview: 34min

Feedback: It was an enjoyable conversation and well-structured. At the beginning of the interview, various definitions of the interview could be clarified, as people do not all talk about the same topic given the broad range of topics.

Appendix 5.6: Expert 6

Transcript for the expert interview

About the master thesis *"Artificial intelligence in crisis management - an analysis of potentials and limitations to enhance top management responses as part of business resilience."*

Name: E6

Company: Anonymous

Position: Senior Manager – Cyber and Strategic Risk

Email address: Anonymous

Interviewer: Sinah Janssen

Date: Nov 8, 2023

Interview Objective:

This survey aims to facilitate dialogue among crisis management, AI experts, and Nova SBE students. In doing so, an exchange of information will take place that targets the topic of "Artificial intelligence in crisis management."

Transcript

Sinah Janssen: Hello, good morning.

E6: Good morning. Yes, it's fine.

Sinah Janssen: That's perfect for me, it works well. Thank you for participating in our interview today. I hope you feel comfortable right now. Niklas has already sent you the declaration of consent. So we've transferred the interview. We'll anonymize everything afterwards, and you only have to answer the questions you're comfortable with. Whenever you're ready, we can start.

E6: Could you remind me of the purpose of this interview?

Sinah Janssen: Of course, I apologize for not clarifying earlier. The purpose of this interview is to explore the implications of AI in crisis management, particularly in practical applications. We've divided crisis management into three phases: pre-crisis (detection and preparation), mid-crisis (communication, decision-making, and performance management), and post-crisis (organizational learning). This research is for a master's thesis, and we aim to identify where AI can enhance crisis management. We're talking to professionals in academia and organizations to gain insights into how AI has been used effectively and where its limitations lie.

E6: Who else are you interviewing?

Sinah Janssen: We're conducting interviews over a three-month period, engaging with various professionals in the academic and organizational fields to get a comprehensive overview of AI's effectiveness and potential uses in crisis management.

E6: Are you working on this thesis collaboratively?

Sinah Janssen: Yes, we are working as a team. We study international management at Nova SBE in Portugal, and our team is comprised of three members. We have divided the subtopics among us: one colleague is focused on the pre-crisis phase, Niklas and I are addressing the mid-crisis phase, and another team member is covering the post-crisis phase. Our collective goal is to discover practical applications for AI in crisis management, as there is already a significant body of research in the field.

E6: I see. Now it's clear. Alright, let's proceed. I have highlighted the questions, so feel free to lead the conversation.

Sinah Janssen: Great. Let's begin with you introducing yourself, discussing your current role, your experience in crisis management, and any relevant experiences you'd like to share.

E6: I am the founder and managing partner of CSA International, established in 1991. We are pioneers in implementing an integrated approach to crisis resilience, which covers risk assessment, issues management, emergency crisis response, and disaster recovery and business continuity in the post-crisis phase. We work across various industry sectors worldwide, with a team of experts solely dedicated to crisis resilience. We have deep expertise in this field and have handled numerous crises.

E6: Our primary focus is on helping clients build crisis resilience, and early on, we recognized that technology could enhance crisis management. In 1999, we developed our first digital solution, "CrisisCom," to address information bottlenecks during crises. We now have multiple tools and solutions, including a crisis academy for e-learning courses, stakeholder mapping tools, and a simulation platform for crisis scenarios. Our work primarily revolves around preparing and supporting clients to build crisis resilience.

Sinah Janssen: Are any of these tools currently utilizing AI, perhaps for scenario planning or data analysis?

E6: We have developed numerous scenarios, including a library of over 250 to 300 scenarios, ranging from simple to complex. AI can provide a starting point for generating scenarios, but it still requires human insights and intelligence to make these scenarios more realistic and connected. AI can enhance the predictability of crises to some extent, but it doesn't guarantee it.

E6: AI can be a valuable addition to crisis management teams for data-driven decision-making during crises. However, critical decision-making, intuition, experience, and soft skills like empathy and mission-oriented thinking are vital in crisis management. We've also developed a Crisis Leadership Competency Protocol that emphasizes a set of hard and soft skills, where soft skills play a significant role, and these are challenging for AI to replicate due to the need for consciousness.

Sinah Janssen: That makes sense. In which phases of crisis management do you see AI potentially offering the most value and where might it have limitations?

E6: I see AI being most beneficial in the decision-making phase during a crisis. AI can provide data analysis and assessments to improve decision-making. However, its effectiveness depends on the organization's willingness to incorporate data-driven input into their decision-making

process. During the pre-crisis phase, AI can help assess readiness to some extent but is limited by the parameters set by humans.

E6: In the post-crisis phase, such as after-action reviews, AI could be instrumental in assessing what an organization did right, what could be improved, and best practices. However, the pre-crisis phase can be challenging for AI since it relies on human input to define the parameters for assessment. AI's impact on predictability depends on the organization's priorities and willingness to act on AI's recommendations.

Sinah Janssen: Interesting. Do you believe that AI might be better suited to predict more predictable crises, or is it equally effective in unpredictable situations?

E6: AI can facilitate predictability to some extent, but it doesn't guarantee it. Even for predictable crises, the effectiveness of AI relies on the organization's culture and its willingness to incorporate data-driven input into decision-making. For example, studies predicting pandemics were conducted, but governments sometimes ignored their findings. AI can assist in making these studies more comprehensive and faster, but it cannot ensure that their recommendations will be acted upon.

Sinah Janssen: I see. So the human element in decision-making remains critical. In terms of AI's impact on crisis management, do you have concerns related to data privacy and security, given that AI can potentially open up vulnerabilities?

E6: Yes, there are valid concerns about data security and privacy when it comes to AI in crisis management. AI, like other technologies, can be vulnerable to security threats and hacking. We've witnessed an increase in security threats, especially in the cyber domain. AI's use may add another layer of vulnerabilities, making organizations more susceptible to malicious intent.

E6: At the moment, we've taken steps to create secure environments for real-time crisis management to prevent organizations from using email during a crisis, which is highly insecure. However, AI could introduce new vulnerabilities and security risks. While I'm not a security or tech expert, I observe a growing concern regarding the security of AI systems, including chatbots like GPT. AI may provide benefits, but it can also expose organizations to more risks.

Sinah Janssen: Thank you for sharing those insights. Is there anything else you'd like to add or any other thoughts you have on this topic?

E6: I encourage you to explore the information on our website to gain a better understanding of our perspective on this topic. Feel free to reach out to me if you have any further questions or need more information. I'd also appreciate receiving anonymized interviews with other candidates as they may provide valuable insights.

Sinah Janssen: We'll definitely provide you with anonymized interviews. Thank you for your time and insights. It's been a pleasure talking with you.

E6: Likewise. If you have any more questions in the future

Appendix 5.7: Expert 7

Transcript for the expert interview

About the master thesis *"Artificial intelligence in crisis management - an analysis of potentials and limitations to enhance top management responses as part of business resilience."*

Name: E7

Company: Anonymous

Position: Principal & CEO, Bryghtpath, Crisis Management & Business Continuity Expert

Email address: Anonymous

Interviewer: Niklas Mauer

Date: 10.11.2023

Interview Objective:

This survey aims to facilitate dialogue among crisis management, AI experts, and Nova SBE students. In doing so, an exchange of information will take place that targets the topic of "Artificial intelligence in crisis management."

Niklas Mauer: Let's dive right in. I hope you're not taking too much time off your free day. Have you had a chance to look at the questions, or would you prefer a brief intro first?

E7: Feel free to give me a brief. I did read the questions and revisited them before our call.

Niklas Mauer: Perfect preparation. As mentioned on LinkedIn and in the guidelines, our goal is to explore various aspects of crisis management, focusing on potential AI applications and also shedding light on the limitations. We want to identify good use cases and understand the current and potential future limitations of AI in crisis management. That's why we're reaching out to experts from different fields, including consultants, non-governmental organizations, businesses, and academia, like yourself. This also ties into the first question.

E7: It would be great if you could share your role at Anonymous and provide insight into your connection with artificial intelligence and crisis management. This will help us understand your answers in context later on. I serve as the principal and chief executive of Anonymous, a consulting firm spelled B-R-Y-G-HT-P-A-T-H. I've been in this role for nine years, following a 21-year tenure at Target Corporation, where I established and led their global crisis management, business continuity, and intelligence program. In terms of crisis management, we specialize in consulting, evaluating, building, and running crisis management programs for our clients. Our clients typically include medium to large enterprises operating globally. Regarding artificial intelligence, we use it internally for content generation, extensively drafting articles and content for our website and podcast episodes. The AI-generated content is then edited by humans for finalization. Additionally, we use AI to process large data sets, particularly in the realm of business continuity, where we deal with substantial data from organizations to understand the criticality of different functions within a company.

Niklas Mauer: Okay, that sounds good. When considering your customers, would you say, on average, they already have advanced technologies in place, or would you categorize them at a medium or low technology readiness level?

E7: It's a mix. We have clients in the technology sector with a high level of technological capability. On the other hand, some companies are less technologically advanced and lag behind in exploring AI and machine learning. So, it varies.

Niklas Mauer: Great. Given that your company is already using AI tools for content creation and data processing, you could say your company is at a high level. Would you agree?

E7: I suppose so. We could do more, but I believe we've done more than some of our peers have. So, it's a positive step.

Niklas Mauer: Moving forward, we've segmented the crisis management process into four steps: detection and preparation, decision-making preparation, crisis response and performance management, and organizational learning leading into business continuity. How would you describe the crisis management process in your company? Does this framework align with your approach?

E7: As a consulting firm, we might differ a bit, but for our clients, I'd say it roughly aligns. Early detection and preparation is a good starting point. The second stage involves monitoring and reacting to evolving threats or risks. The third is the response stage, actively addressing pending threats. The fourth is short and long-term recovery after the response. The fifth phase is organizational learning or program maturation following recovery.

Niklas Mauer: Interesting. Your approach adds a monitoring emphasis. Moving on, what, in your opinion, are the most critical or challenging factors related to crisis management?

E7: Yes, okay. I think the most challenging factors—I see a couple of things. One is that many companies and organizations don't invest in preparation. They are unwilling to strategically invest in advance of a crisis actually happening. In my experience, companies that do invest can respond more nimbly, and this pays off for them. We saw that with COVID in our experience. But a definite challenge is the willingness of organizations or even nations to invest in preparedness. The second challenging factor is the difficulty in recognizing and reacting to emerging threats in a timely manner because you may not perceive the threat for what it is. You mentioned information handling, and I believe that's part of it—understanding and connecting the dots of what's in front of you. The third challenge is that organizations sometimes become fixated on preconceived scenarios, making it challenging to see how two or more seemingly unrelated issues compound into a larger crisis. They find themselves unprepared because they didn't anticipate or build a framework for such situations; they just had plans for specific crisis situations. When faced with something novel, they didn't know how to respond. These are a couple of factors that we often encounter.

09:13 Niklas Mauer: So, to summarize, for the initial steps, companies are often more reactive than proactive.

E7: Yes.

Niklas Mauer: Regarding the compounding issues leading to a crisis, do you see potential for AI to assist in analyzing data and providing recommendations or identifications?

E7: I would agree with that.

Niklas Mauer: Is there anything in place yet, or are there some tools around that you are aware of? Right. Okay, moving on. Do you have any technologies or tools, or what kind of tools do you use for the different phases you described?

E7: We don't use—I shouldn't say we don't. It's not true. From a tool standpoint, I don't know if it's technology, but it definitely helps our clients build plans. Companies that are further behind from a technology standpoint often have plans in the form of Word documents, PDFs, or printed documents. Some of our more technologically capable clients use specific business continuity or crisis management software, as well as mass notification software. These tools help them understand and manage crises or prepare for them. These are quite common. Additionally, some organizations have built their own capabilities because there wasn't suitable software on the market to meet their needs.

Niklas Mauer: So, when discussing the preparation phase, are they using general software to identify, for example, natural disasters, and at the same time, conducting social media tracking? What are you mostly referring to?

E7: Social media tracking is definitely one aspect they use. Other software provides threat intelligence by tapping into various open-source feeds from government entities, or they've developed their own proprietary capabilities. These help companies gain a better perspective on incoming threats and risks. Additionally, there's a market for specialty business continuity and crisis management software for plan management. It's more focused on business continuity, but it certainly streamlines the process of putting plans into a system, making plan updates easier, and simplifying upkeep compared to manual documentation.

Niklas Mauer: What would you describe as the key benefits of AI, and do you also see limitations when using AI in this context?

E7: Yeah. Yeah. So, I've seen AI evolve in this space over the last six months. There's a threat intelligence platform that some of our clients are using, utilizing AI to process social media and other open-source data primarily from government sources about incidents. It then triages and assesses them against a set of criteria, providing more intelligent threat alerting in an automated way, a capability that didn't exist six months ago. We're also witnessing AI entering the specialty business continuity software market. Instead of relying on humans to rate the criticality of functions within an organization for continuity of operations, AI is now taking on that role. It processes a larger volume of inputs and data, leading to more accurate conclusions about capabilities and interdependencies. OK.

Niklas Mauer: Do you see some limitations as well, or is it currently only the upside of the coin that's predominant?

E7: I think the limitations are that there's still a lack of imagination in the space of what we could do because it's so new and largely untapped. That, to me, is a limitation. The second is that these technologies are only as good as the data we're inputting into them. Understanding what data could help advance these capabilities remains to be seen. Many experts we interviewed agree that obtaining and validating good data is challenging.

Niklas Mauer: Going one step further in our framework, do you also see the potential for decision-making to be supported by AI or even overtaken by AI?

E7: I think AI can recommend or even make decisions in these situations. Particularly, I see this playing out when an organization faces disruption and needs to understand the impact and prioritize which functions to recover first. Because it's a highly data-driven decision, AI is likely to make better recommendations than humans. While this capability hasn't fully materialized yet, I know it's expected to be integrated into Business Continuity software before the end of the year. That's really interesting.

Niklas Mauer: Would you also say, therefore, it reduces bias in some way, avoiding leaders from prioritizing outcomes for their department or personal gain, and instead, the AI software focuses more on the overall picture?

E7: Yes, I would completely agree with that.

Niklas Mauer: Do you also envision the potential for AI to take on decision-making responsibilities? Some experts suggest that many leaders still prefer making decisions independently due to liability and responsibility concerns.

E7: I'm not sure if I would trust it to make its own decisions yet, but I believe that time is coming. I currently see it more as a way to recommend decisions that can be confirmed by a human. Okay, so, but I think that day is coming when it can make its own decisions. Interesting. So what you're saying is the best outcome at the moment could be achieved through co-working, co-creation. Yes, nice. And in organizations, especially during a crisis response, do you see potential for AI in performance tracking, decision-making, and communication?

Niklas Mauer: I think there's an opportunity for AI to play a larger role. I'm not entirely certain yet. Regarding communication, we may have borders in place, like addressing multiple stakeholders more effectively or, at least, for an initial draft before reviewing and sending it out. So, kind of incorporating some co-creation as well. I think that's happening. I mean, my email client already integrates AI and can summarize complex message threads, rewrite emails for different audiences, and even translate them into another language. I believe these capabilities are already quite advanced and will continue to progress, making the process more efficient. So, you're suggesting that there could be benefits in reducing the workload for people if you automate operational tasks.

E7: Yeah, I think I could see that happening. I do not. Okay, great.

Niklas Mauer: From your clients, do you know if there's performance tracking and organizational learning in place afterward, such as conducting lessons learned, analyzing KPIs, and reviewing decisions? Or is this not as common in practice?

E7: I haven't seen it work effectively yet in crisis management. We attempted to use AI to summarize a lengthy set of observations and recommendations in a crisis exercise, but it didn't provide the output we were looking for. I believe there's an opportunity to do more with that, but I haven't seen it done effectively yet.

Niklas Mauer: Okay, but it's great to hear that you're already making efforts and investing resources there. How is it done instead? Do you gather decision-makers to review the process, or are you exploring how organizational learning or the business continuity aspect is currently handled?

E7: This was more internal to our team. We didn't share this with our clients, but we took a database of observations and recommendations and ran it through a couple of different AI tools with some training to attempt generating the bulk of an after-action report, for example, or creating other summaries. It was a mixed success. I believe we would probably need to develop a more specific tool for that capability rather than relying on something like ChatGPT. But overall, you work together with your clients, and as a consultant, you also assist them with organizational learning or lessons learned. Is that correct?

Niklas Mauer: Are there any KPIs in place that you use, or is it more based on your outcomes, essentially tailored to each specific case?

E7: We haven't had specific KPIs from the exercise or situation I described. However, I've seen KPIs used with AI in the business continuity tools. They summarize a lot of data related to existing plans or the criticality of functions in an organization and suggest KPIs to help the client better understand their organization. Beyond AI, clients generally use KPIs to track their decision-making in crisis management as well. If I understood correctly, yes, primarily around process maturity and compliance within the crisis process. For instance, if it's a checklist-driven process, they track how effectively they execute it—a straightforward KPI for them to use.

Niklas Mauer: Okay, awesome. Following up on the questions, what would be the critical skills and resources required for an organization to succeed in crisis management and to integrate AI into their crisis management process?

E7: For companies to succeed in crisis management, they need to be willing to invest appropriately in a program that meets their organizational needs. They should practice conducting exercises outside of actual crisis situations to improve as a company. Resources-wise, they need expertise, whether internal or from a company like ours to help build and manage it for them. Integration faces a hurdle, mainly fear, as many companies are afraid of using AI or losing control of their data and intellectual property. Addressing this fear often involves putting guardrails in place, primarily driven by knowledge concerns. Additionally, there aren't many tools available today for companies to use AI in crisis management, so we have to wait for the industry to create or integrate them into existing tools.

Niklas Mauer: Would you say it's more likely that different companies will use different solutions for various events or tracking, and only large companies will develop their own solutions due to the significant resources required? Also, considering the rarity of data input if it's only applied to a specific company.

E7: I think that's a fair way to put it. It ultimately comes down to leaders embracing new technologies. I have two clients in the healthcare industry in different parts of the United States. One has strongly adopted AI, using Microsoft's co-pilot program for Microsoft 365, browser AI capabilities, and more. It's driven by their IT organization. The other has banned it entirely. The one adapting to AI more quickly will likely emerge stronger due to those capabilities.

Niklas Mauer: Regarding leadership support, are there other skills or requirements leaders need to ensure effective AI implementation?

E7: It's beneficial if companies establish a framework for the responsible and ethical use of AI in the organization, including data protection. Companies should encourage employees to innovate and experiment, fostering innovative ways to move the business forward.

Niklas Mauer: Talking about data protection, are there currently issues arising from privacy or data privacy concerns, or are these adequately addressed by general data privacy regulations?

E7: I do think there's concern there. Most of it has to do with companies or individuals not understanding the controls in place in some of these tools. Certainly, there are differences in legislation; GDPR in the EU is more protective of individual privacy than most privacy laws in the US. This difference could contribute to being more advanced and less negative about using AI, reflecting a mindset shift.

Niklas Mauer: Yes, I think so. Okay, awesome. These are insightful pieces of information. Overall, would you say that there are still human skills needed or irreplaceable by AI in the crisis management context?

E7: I think there are still elements that AI can't replace. Yes, basic human requirements and leadership are still necessary. There's nuance that AI doesn't always grasp. It's similar to the issue in content creation; the best AI-generated content for our website still needs editing because it lacks the same nuance and understanding as I do. While it may have all the facts correct, it doesn't capture my tone, for example. Yes, sure. Right. So, I believe there are things that still require human intervention. I don't think AI will necessarily make the same decisions or perceive the same nuance in a crisis as I might while leading a client through that situation. However, I trust AI to provide the best recommendation on what I should do.

Niklas Mauer: Okay. Maybe two follow-up questions for that. What role do you think emotional intelligence plays in the crisis management process, if any? And the other one is, maybe we start there, and the other will come up in a bit. Okay.

E7: No, I think you're right. Emotional intelligence is what I was considering. That's the kind of nuance I wouldn't expect AI to pick up on yet; maybe in time. I think about profoundly challenging situations I've been in, where making the right decision in the crisis wasn't necessarily the challenge. The challenge was understanding how the team or individuals in the crisis were experiencing that and how we needed to support them. I'm not sure AI would capture that yet.

Niklas Mauer: Okay. Perfect. Yeah. Maybe now the other thing came back to my mind. If you're saying that AI will help or could help come up with recommendations, how would you see the part of hard choices where outcomes are pretty similar or hard to distinguish? Do you see limitations of AI there?

E7: Yeah, I do. Yes, I think so because I think that's where the nuance might be missed. If we always made decisions just on data, it might give us the best recommendation, but sometimes there are other non-data-driven factors that may lead us to a different decision. Interesting. Yeah, that's perfect because this is something that we often came across as well. If you have similar outcomes, it's kind of hard, as the background of AI is some function and some models. If the function couldn't be solved, you will have some limitations there.

Niklas Mauer: Right. Okay. Maybe regarding the last couple of questions, how do you, just from a personal side, how would you say that the role of AI in crisis management will evolve? And do you think it will take over more parts of the crisis management process?

E7: I mean, I think it will. So I guess in a couple of ways, I expect it will continue to evolve its capabilities in terms of understanding more nuance, being able to consume different kinds of information. For example, I don't think ChatGPT, which is OpenAI's approach right now, can consume video, but I'm told that's coming in 2024. So how does that start to change? For example, how do we monitor video or monitor the news in ways that we didn't before, making it even more intelligent? So I expect we'll see evolution in those areas. I think those additional inputs will allow it to draw new insights and become more intelligent, so to speak. That's where I see things going. I think that will help it understand more nuance over time. I think we'll see more software come on the market in this business continuity crisis management space with more AI capabilities. So we're going to see AI capabilities added to software that's on the market today as they expand their capabilities.

Niklas Mauer: So kind of following the general trends, there are a lot of companies trying to implement or have implemented AI in their solutions at the moment, increasing efficiency or output. As you said, with Google or Microsoft solutions where it's integrated into 365. And would you also say that the limitations we mentioned earlier will remain, at least in the midterm, like talking about emotional intelligence, etc.?

E7: I think we're going to be surprised at how quickly it evolves. But I think these huge steps forward that we saw in the last couple of years will probably start to become less surprising to us, and things will probably move a little slower over time.

Niklas Mauer: This is kind of like the typical curve where you have exponential growth in some way, or like the logarithmic growth that becomes less and less over time. But still, it's hard to predict, kind of looking in the glass and seeing what's coming.

E7: Yeah, that's exactly how I'm thinking of it.

Niklas Mauer: And, maybe, just as a last point, is there anything else you'd like to add from your side that you would say is worth mentioning in the context?

E7: I mean, I think I've been surprised at how much AI has come along in 2023. If you had told me a year ago that we would be generating content primarily through AI and editing it by a human, I would have told you that you were crazy. But it has completely replaced how we do that in our business. And I expect that kind of capability in other parts of what we do will completely change the same way that it's changed how we write for our business. So I anticipate this is going to continue.

Niklas Mauer: Okay, that would be from my side. But I can offer you these insights that are so insightful and help a lot to structure and build on the thesis. We would be happy, or I would be happy, to share my results of the thesis as well as other transcripts if you're looking for.

E7: I would love to see your output when you're done. And your school's in Portugal.

Niklas Mauer: Yes, it's right at the beach. So we're still kind of lucky and blessed with good weather. Nice. Okay. Yes, so once again, thank you so much for your time and yeah, all the best and joy. Thank you for your business feeling in Minneapolis. Thank you. Stay in touch.

E7: All right. Yeah, I look forward to hearing from you. Good luck with the rest of your research.

Niklas Mauer: Awesome. Yeah, thanks. Have a good one and enjoy the weekend.

E7: You too. Bye.

Description of interview situation:

Location: Online

Interview recording: Microsoft Teams conference recording was used to secure the data. Thanks to a quiet environment, high-quality audio files could be generated here. These can be accessed via the following link:

Short description of the atmosphere

Duration of Interview: 37min

Feedback:

Appendix 5.8: Expert 8

Transcript for the expert interview

About the master thesis *"Artificial intelligence in crisis management - an analysis of potentials and limitations to enhance top management responses as part of business resilience."*

Name: E8

Company: Anonymous

Position: Senior Consultant – Quality and Risk Management

Email address: Anonymous

Interviewer: Niklas Mauer

Date: 10.11.2023

Interview Objective:

This survey aims to facilitate dialogue among crisis management, AI experts, and Nova SBE students. In doing so, an exchange of information will take place that targets the topic of "Artificial intelligence in crisis management."

Niklas Mauer: Good morning, Tobias. Due to time constraints, let's dive right in. First question, I'm quite familiar with PCON, but could you tell me a bit about your role, the organization, and touch on the points related to artificial intelligence and crisis management?

E8: Certainly. Anonymous is a strategic consultancy within the VW Group, a 100% subsidiary of Porsche AG. Originating in the automotive industry, Anonymous emerged during the crisis phase of Porsche AG in the early '90s. Back then, the focus was on resolving the industry's and Porsche's first crisis, with no AI and the presence of Lean Management to optimize production processes. Managing the crisis with the available tools and technologies at that time was the goal, and that was over 29 years ago. Celebrating its 30th anniversary next year, the company has evolved into a multinational and thematically diverse organization. We apply our expertise in various industries, addressing diverse issues for customers within and outside the VW Group. Our focus lies on strategic, organizational, and procedural perspectives, aiming to solve our customers' diverse problems and achieve the best possible results. Clients usually approach us not when everything is going well but when there are challenges or improvements needed. Crisis management is, of course, a significant topic. In recent years, we've dealt with challenges such as semiconductor management and various supply chain difficulties—not just semiconductors, but also other problems. We actively support our clients in various functions, from enabling suppliers through quality management to procurement, strategy, optimization, and the entire organizational improvement process. We've been involved in small, two-person teams at individual suppliers and large teams managing semiconductor logistics for the entire VW Group, with projects involving up to 50 people. We have a diverse range of experiences in this area and consider ourselves one of the market players. Personally, I've been with Anonymous for two and a half years, part of the Operations Team in the Quality Competence Center. My background is in electrical engineering, having studied at TU Munich. I pursued a bachelor's and master's degree, had stints in Norway and Australia, and then spent four years in a consultancy firm in the Systems Engineering sector in Munich. From there, I transitioned to Anonymous, focusing on software quality and other related areas.

Niklas Mauer: Exactly. I remember when I was at PCON, the whole AI team started, and there were a few initiatives. Could you maybe share a bit about how advanced you are in terms of technology or how you're positioned in that area?

E8: Yes, technology is always a tricky thing. We are not coders, so there are others who can do that better and probably cheaper than we can. What we do is the strategic consideration behind it and the implementation control. We're not an Accenture or Capgemini team with a large array of development capacities to optimize an AI tool, set up some cloud, or do programming. Instead, we highlight the technical possibilities and implement them with the technology. Personally, I can only endure a PowerPoint presentation. I'm not really into the red-green coding.

Niklas Mauer: But this probably means that the AI team in use is more for internal purposes, indicating that, like any consultancy currently dealing with generative AI, it's more of a point of focus.

E8: Yes, exactly. They are a special case, conducting large data analyses. However, it's more about extracting optimization models from large data sets for further analysis and drawing conclusions. I'm less involved in that, but, for example, they examine the entire railway network, figuring out how to place construction sites in the railway network to minimize the impact on passenger transport schedules. It involves dealing with a large dataset with many numbers and values, which is not my area of expertise.

Niklas Mauer: Yes, okay, I understand. Then I would like to focus a bit more on the management aspect. What do you see as the biggest challenge or limitations in a crisis?

E8: Mhm. The biggest challenges in a crisis, in what sense?

Niklas Mauer: I mean, especially in terms of time, is quick reaction crucial, or is it more about the cost factor? Do you think one needs to assess the impact and accordingly assemble the teams?

E8: Yes, I think it's like a triangle where each part depends on the other. The time factor is direct because the quicker you react, the lower the damage. The financial factor aims to minimize damage because crises are expensive. The third factor involves risks related to human life or reputation damage. These three are directly connected, and you can't really weigh one against the other. I believe each one is important in its own way.

Niklas Mauer: Yes, because it's a bit like that magic triangle, as we often know: time, cost, quality. It's challenging to consider them individually; you have to look at the context.

E8: Yes.

Niklas Mauer: Now, maybe a bit more detailed into the process. We talked about having crisis management, an identification phase, preparation, a decision phase where decisions are prepared and made, a response phase where you see field communication and some performance management, and finally, an organizational learning phase to say, "These are the lessons learned." Do you see potential there, or do you already have technology in use, AI or non-AI, where you say, "These tools are used, and they are somewhat best practices for each phase"?

E8: Yes, so, the early phase, as you've described it, I would divide into two parts because you mention the preparation phase and early detection, which, for me, are two different topics. On one side, there's the preparation in terms of anticipating that something might happen and how we prepare for it. I would see that as the preparation phase. And then, as the detection phase, where you are on high alert all the time, constantly monitoring and assessing what could be emerging. I would separate these two topics. I can't name specific tools we use, but in terms of the preparation phase, topics like raising awareness among employees, providing training on technical issues, and addressing the associated risks, implementing appropriate safeguards, and designing processes on how to respond—all these crisis plans constitute the first phase of preparation. In this phase, you can probably use AI to identify weaknesses, determine what we need to prepare for. So, where are the security gaps, and where could a potential attack occur? To examine this from a process mining perspective, I have not the expertise.

Niklas Mauer: So, in my understanding, this could also involve internal audits, which could be taken over to identify vulnerabilities more deeply and understand the interconnections.

E8: Yes, exactly. I think, in that case, you can initially design a process or set up an escalation cascade—determining who calls whom and who decides when to pull the plug. I don't think I need AI for that; humans can handle it quite well. It's not complex enough to warrant using AI because it's a one-time thing. If it doesn't work again, the system is activated, and the process is set in motion. And are you watching for attacks or trying to detect things? Detection is, I believe, the most critical point when you have a large IT system. It involves antivirus scanners but in a more specific setup that continuously monitors your system and reacts to anomalies. So when I talk about a crisis, in this case, it leans toward an IT security crisis. This is certain before heading into more crisis management aspects, like a semiconductor crisis. You could also detect early signs, such as container congestion in a port or delays, or utilize financial data or trade registry extracts from suppliers. You look and realize that an entity might be sliding, and a red flag should go up, prompting us to investigate. In such cases, these are magnitudes and scales where you could probably use AI to build a comprehensive model and perform risk analysis.

Niklas Mauer: Because otherwise, one would say that the volume of data is just too large and unmanageable, and it would take significantly longer if you input data like trade registries into AI. This is particularly relevant for the port situation or the geopolitical situation to get the most up-to-date situation.

E8: Yes, I believe that as a human, you can grasp it, but the volume and interconnectedness of the topics are so vast that it eventually becomes overwhelming. You can't sit so many people down to constantly look at a large tracking bed on the world map, identifying problems here and there. Instead, you need some form of categorization, like focusing on these five points, and determining this prioritization, likely with a large team.

E8: Then, specialists ensure it, but that brings us back to the cost factor we mentioned earlier. Do you see potential, for example, in the case of semiconductor issues, during the decision-making phase? Could AI, based on all the data collected, prepare decisions, suggesting, for instance, alternative suppliers or proposing specific directions?

Niklas Mauer: Especially considering ethical considerations.

E8: I think it might get too granular. You can make specific improvements, but it's more about optimization analyses. For example, you can assess which semiconductor supplier is crucial to Audi or VW. You can optimize the model, but it's not a scenario where you need artificial intelligence. It's more like running the numbers once and then inputting figures here and there, simplifying the process.

Niklas Mauer: Yes, I was thinking more about the initial step, focusing on suppliers to Silvio, where you consider various semiconductor manufacturers.

E8: Yes, it's already in place. So, an analysis and preliminary screening, definitely scanning for potential issues. But now, with two suppliers, choosing between them isn't a career decision. The numbers involved in these discussions are too vast; we're talking about too much money. Supplier negotiations are still conducted between people, unlike a storm and a power exchange, where algorithms bid for cheaper winter electricity.

Niklas Mauer: Got it. So, you're saying that the interpersonal factor, especially in negotiations, is crucial. And, in general, regarding this issue, there's a bit of liability and responsibility. Decision-makers must bear the responsibility for decisions; hence, the decisions are made by them.

E8: Yes.

Niklas Mauer: Perfect. Now, concerning Crisis Response, do you see examples or know of examples where, for instance, communication plans could potentially be automated or at least generated by AI? Then, one could review and adjust them, lightening the load on the management team.

Niklas Mauer: Have you come across instances where, for example, meeting minutes are used for task derivation? The AI would automatically assign tasks to individuals, thus operating in a more operational manner.

E8: Yes, I think it's a nice idea, but if the AI generates tasks from meeting minutes, they often end up in my trash or inbox; I don't see people accepting that. It's not very practical for daily use. Setting up such a process could be a one-time thing. A communication matrix, for instance, is a one-off. AI could optimize the process of creating something like that as a product of consultancy. You might say, "We optimized it with AI," create a plan once, or maybe update it occasionally, like changing an email address when the responsible person changes, but deriving tasks from the classroom protocol would be challenging.

E8: I don't see that. I believe people's pride and the involvement of individuals are too high. It's more of a top-down approach where a decision is made, and then the team says, "Now, this is what we're going to do." We present options suggested by AI as potential solutions, and then what? We need to address that, but automating the analysis and derivation of tasks from a conversation and then sharing them—I think that's where people struggle.

Niklas Mauer: Yeah, it's interesting to hear because, in other conversations, points like these came up. There was this idea that interviews can be a mutual challenge.

E8: Yeah, maybe I'm more immersed in the future industry. Shoulder tapping is prevalent in the automotive sector, unfortunately. The top tends to dominate the bottom. It's somewhat ingrained in the industry.

Niklas Mauer: Yeah, I've witnessed that. Even if the tasks were clear, they weren't done until a consultant arrived. If the manager said to do it, then it was done.

E8: Exactly, the client demands it. If the client says we should do it, then we do it—whatever makes the client happy.

Niklas Mauer: And maybe in the last steps, do you see potentials in organizational learning, where AI could provide support? Because sometimes learning doesn't happen as expected.

E8: Because we don't really learn that way.

Niklas Mauer: Yeah, a bit like revisiting crisis management or the plans we created before, taking another look, seeing if adjustments are needed. Within the analysis, considering what decisions we would make and their impacts. Was it always the best decision?

E8: Yes, but that's not the highly sensitive application. So, it's like an idea: when you get new employees, they need to do it once. Of course, you want to optimize and personalize it a bit with AI, but it's not the area where there's a lot of money involved. Whether the sensitization or the training goes well or the video looks good or not, I think it's less relevant. But in terms of attack recognition, do you recognize crises? Early detection is about money in the end.

Niklas Mauer: Yeah, right.

E8: I don't see it that way. I don't think there are major technical difficulties in analyzing or processing that.

Niklas Mauer: Perfect. So, in the workplace, it's relevant. What do you think are the essential leadership qualities, perhaps those especially relevant in crisis management?

E8: Leadership qualities include having the ability to make decisions and then making decisions simply because the time criticality is too high. You don't have the time to wait long, but a timely decision must be made as quickly as possible, even if it may not be 100% accurate. The greatest danger is not making decisions. And if the decision is to call my boss and report, just having that certainty hanging on the information board delays everything. Every minute counts as a delay. So, I believe that the ability to make decisions is one of the most important. The technical know-how of how to react, being aware of the risks without having color sensitization and knowing what to do accordingly is the second. What else would I say?

Niklas Mauer: Exactly. So, for the major themes, we also revisited this. What's missing is emotional understanding or emotional intelligence, the ability to address different people appropriately, which often helps in situations, especially since jobs are associated with it. Having emotional intelligence helps understand different people and address them correctly.

Niklas Mauer: That's right, but there were also various crisis situations. We also faced challenges outside the industry and collected information from UN partners, where the human aspect is sometimes given higher importance.

E8: Okay.

Niklas Mauer: Exactly. Maybe the last questions then we'll wrap up. Do you see the potential for AI to play a stronger role in case management in the future, or do you think, based on your current knowledge, it might be limited to the current use cases, such as detection, with decision-making remaining with the executives?

E8: Yes, I would say what we currently do will certainly improve, and my horizon of imagination is probably limited. However, being scientifically and technically inclined, I can't rule out possibilities that I may not be able to imagine. Can the chat function? If it works now, I'm optimistic that there are still much better options and that there will definitely be more developments in the future, but I can't pinpoint exactly where.

Niklas Mauer: Yes, it's good; currently, everyone is sort of looking into the crystal ball, and no one really knows what's coming next, especially with technologies.

E8: Yes, but I must say we are already somewhat deep into the technical aspects. We don't lack technical understanding, and we engage with the topics. But everything you can use to avert crises can also be used on the other side to trigger a crisis. This back-and-forth will always be there; it's a constant cat-and-mouse game. As soon as technology is there, there's also the risk of it falling into the wrong hands and being used for negative purposes.

Niklas Mauer: Yes. Do you have any final points you'd like to mention or emphasize under this?

E8: I think that covers it well, and there's nothing more to add. I would appreciate it if I could receive the work results later since the topic interests me a lot.

Niklas Mauer: Of course, we'll send the documents to each interview partner as discussed. I'll notify you once the analyses are completed. Thanks again for your time. Thanks. Bye.

Description of interview situation:

Location: Online

Interview recording: Microsoft Teams conference recording was used to secure the data. Thanks to a quiet environment, high-quality audio files could be generated here. These can be accessed via the following link:

Short description of the atmosphere

Duration of Interview: 43min

Feedback:

Appendix 5.9: Expert 9

Transcript for the expert interview

About the master thesis *"Artificial intelligence in crisis management - an analysis of potentials and limitations to enhance top management responses as part of business resilience."*

Name: E9

Company: Anonymous

Position: Head of Operational Risk

Email address: Anonymous

Interviewer: Julia Steyer

Date: 20.11.2023

Interview Objective:

This survey aims to facilitate dialogue among crisis management, AI experts, and Nova SBE students. In doing so, an exchange of information will take place that targets the topic of "Artificial intelligence in crisis management."

Julia Steyer: Alright, let's kick things off. Firstly, it would be fantastic if you could give me a brief overview of your organization and your role within the company. Just a quick introduction, and also touch on how you intersect with the topics of AI or crisis management.

E9: Sure, I work in risk management for an internationally operating bank, specifically in the context of Brexit. We have around 1200 employees, not members, employees. I'm the Head of Operational Risk myself. This encompasses the resilience theme, and ultimately, in our context, we handle very large volumes of data every day. We deal with highly heterogeneous data—operational risk spans from handling natural disasters like pandemics to contact issues, technology challenges, outages, process errors, and even fraud. So, my field within the risk domain is diverse, extensive, and involves a multitude of heterogeneous data. We constantly emphasize the fact that, compared to Credit Risk or Market Risk, Operational Risk entails a significant and highly diverse data portfolio.

Julia Steyer: Great, got it. To put things on a bit of a scale here, considering your company's size and the industry, how would you, let's say, rate the tech readiness or adaptability, from a level of one, basic principles outlined, to, say, ten? One to ten.

E9: Well, we do have a lot of data, which is something banks, in general, excel at—abundant, deep, and highly heterogeneous data, as I mentioned. And these data sets are genuinely complex. So, considering the scale and speaking for my current employer, I'd say we're maybe at an eight.

What's missing to reach a ten is essentially contextualization. That's what I envision, even from our earlier conversation. What's still lacking or what's the tip of the iceberg, the icing on the cake, is the ability to contextualize and interpret all these data sets. Yes. It's not just about focusing on Parameter A or Parameter B, but having these parameters learn to communicate with each other. This would provide risk managers with a sort of risk radar, indicating, "Ah, there's an issue in this area because the power outage is becoming more frequent in a specific

location in Europe." It's an apparent risk, but how can you contextualize it, perhaps with other data, to achieve better predictability? So, the data is there, but they need to communicate better. As a human, I can't link them together effectively; technology needs to assist in making the data converse, enabling better risk predictions. That would be my response.

Julia Steyer: Okay, great. Yeah, this is somewhat related to my second question. So, when you mention that certain elements are still missing to truly leverage technological progress in a sense, if we consider different phases—I mean, you've already touched on early detection—if we look at these process phases a bit, like early detection, strategic decision-making, performance management and control, all the way to organizational learning, how to learn from a crisis, what limitations or challenges do you currently see in the realm of crisis management processes or in terms of information processing, time, and cost factors?

E9: So, due to the fact that we have highly heterogeneous data, spanning a broad spectrum, if I may say so, there is essentially a lack of centralization of this data. We need a portal solution where everything comes together because, at the moment, we only have single-track notification channels. For instance, if we receive specific emails indicating that an indicator has shifted from green to yellow or red, these notifications are channel-specific. As I mentioned, contextualization involves connecting the data with each other. Perhaps we need to initially park the data in shared data repositories, and regarding communication, we rely on the tools themselves to evaluate them. However, there is a lack of harmonization per tool or data silo. A significant portion of the process is still very manual, involving a lot of manual work in Excel and PowerPoint to prepare this early detection. In the next step, because we are familiar with certain indicators, we can automate and say, "Okay, we want this set of indicators and this dashboard every month." There are institutionalized processes, but they are relatively slow, not very agile, and not particularly punctual regarding escalation. Senior managers also need to log into tools and initiate specific queries. Essentially, what is missing is an autopilot – speed, fuel, maximum speed, RPM, temperature gauge or engine temperature in that direction. I would like this cockpit vision to better transparently present issues to senior management. If we see a problem in a specific country, we should be able to go in and contextualize data related to that situation. It exists partially, but it needs to be consolidated into dashboards, radar systems, risk radar systems, and machine learning. I have no exposure to machine learning; I don't believe our systems are advanced enough for that.

Julia Steyer: Alright, that would have been my next question. Can you already mention in some form which tools are currently being used at your end to get a bit more specific?

E9: So, we ultimately use databases and browser-based dashboards, with Tableau being a keyword. It goes beyond Excel pivot tables, a mix of Excel and Access where one can compile custom queries. However, it requires a certain level of user experience. It's not something a senior manager or the board can simply say, "Please click together an Excel sheet yourself." There always needs to be a defined point, exact, where the key data points, the key data parameters, are recognizable and explainable. In principle, it should be intuitive so that one can drill into the data oneself, whether it's by region, product, employee—whatever the depth of analysis requires. Having a self-service capability that is adjustable based on the question from a VP, a board member, or an analyst—that it's calibrated in terms of evaluative capability. Going to the entire board or the supervisory board is not yet ingrained; these are still somewhat manual processes, where PowerPoint is also utilized.

Julia Steyer: Okay, I understand. In this context, do you see any potentials or advantages of AI implementations in crisis management, speaking broadly? Not necessarily specifically in your company's setting, but is there something where you say, "Okay, there is definitely a need, or this could be beneficial"?

E9: Yes, for example, I have a very small team, and we have quite limited resources. We still use quite a lot of resources to identify the problem before diving deep into the analysis. If we can delegate the identification phase to an algorithm, to the machine, then we can ask specific questions about the problem. In essence, humans still provide the most significant value because they can explain to the board, for instance, whether the issue is repetitive or not, what the problem actually is. It always takes a certain run-up, like in ski jumping. The chance—it's not just about jumping well, but you also have to prepare the jump well. We lack automated tools that would allow us to dive into this analysis, into this deep-dive phase more quickly. You know what I mean. Technology can only support us in this regard; it needs to support us much better so that we can contextualize, tell stories, and focus on certain events.

Julia Steyer: Very good that you brought that up. Perhaps in this context, if we flip the script a bit, what abilities and resources does an organization need, or from the human side, what needs to be provided to effectively integrate AI into the crisis management process?

E9: Well, you know, it requires the initial ability to accept these tools, to understand them first. Honestly, I consider myself a bit of a technology skeptic in a certain way—how everything is sold to me and how everything supposedly works. Ultimately, it's just connecting databases and asking smart questions. But, you need an understanding of how the algorithms actually work, what they can do, and what they can't do—very important. Then, of course, you need people or processes to enable that. Just because I'm here in this organization and may have a rudimentary understanding doesn't mean I can apply it. There needs to be an enabling process through consultants, maybe university information providers like you, your team, I don't know, to explain, essentially, that contextualization doesn't happen in the actual analysis but before. What can AI actually do, and what can't it do? Yes, I still think it's a bit of a black box, and perhaps, alongside the technical hurdles of capacity and power consumption and so on, I believe the very first hurdle is that we need to adapt human behavior. We need to be guided to understand that using AI for this process means focusing on B instead of A. It's not something that happens automatically. Understandable. In terms of resources, as I mentioned, we need these enablers, and it might take a bit of time to grasp and understand it ourselves.

Julia Steyer: So, essentially, there needs to be an exchange, opening up to these techniques, and then understanding how to actually incorporate them into daily use?

E9: I think that's really important. Understand. And skills, of course, maybe somehow. I don't believe we need to code; people who can code are in high demand in the market, but I don't think the senior management is capable of that, and I, myself, perhaps not either. That's where we need the enablers again, who take care of the question, as in a physics class: problem identified, solution sought. How do we get to the solution, and how does the AI topic specifically help us there? I believe that might be the core role for the next two, three, four years.

Julia Steyer: Yes, I understand. So, would you also say that a certain insight, bringing together requirements and leadership qualities, perhaps even at the top management level, is needed? As you briefly mentioned earlier, the mindset to get familiar with AI, to somehow accept the tools

in some way, to see a solution, and then to have the skills and knowledge to carry it out. And then maybe also to show specific examples, what might be an industry standard, because I think banks are quite varied in their approaches, to conduct a benchmarking analysis, where is this being used?

E9: So, the topic of data protection and information security is very, very significant. It would be a lie to say I've had touchpoints with it. I predict, based on this interview, what the possible issues could be if we were to implement this on a massive scale, how one would need to defend that. Yes, I believe it's a parameter that must be considered in the matter—how to ultimately handle these data, how to protect them, where they are stored, in the cloud or not, in insecure third countries, and so forth. So, it must be clear as an analysis parameter how the data is protected, how the data is handled, and the protection of the data. Germany is very strict compared to other countries due to its particularly high standards. In principle, there must be concrete and reliable answers to these questions about how exactly it works, how the machine deals with it.

Julia Steyer: Okay, then maybe to ask you a concluding question and to hear your personal assessment once again. How do you see the development in terms of the future outlook and the role of AI in crisis management? And a classic question, how do you see the whole aspect of AI potentially replacing humans, especially in terms of resilience crisis management and the integration of AI systems, where you say, okay, there is definitely potential there, and it could be established and integrated in some form.

E9: Let me think for a moment. Right, so ultimately, how should I put it, it's almost philosophical. It's, of course, desirable if we could mitigate the weaknesses of human decision-making through AI. In principle, if we could control everything through machines, that might be an ideal state, and we must advance in that direction, promoting automation, not just viewing and analyzing data manually, singularly, and non-contextualized. So, it clearly has to go in that direction because the data volumes we have are simply unmanageable. That's clear. On the other hand, as a risk manager, I keep saying this in lectures, banks need to understand and have proper control over their machines. That's what I said, not just from a regulatory standpoint. Amidst all this fantasy, we always need to understand what the machine is actually doing, and we must partly justify it to regulators. When we have interview processes, make credit decisions, or other decisions, including crisis management. Essentially, we need to create a robust tool that we give to people so they can guide themselves even better and more confidently in crisis situations. There's always a lot of chaos, a lot of emotion. It requires analytical understanding and a toolkit, and for that, it requires AI. AI also needs to be constantly controlled, as I mentioned, but it needs to be repetitive. That's how I see it to that extent. A significant weakness is, of course, always the human aspect, human decision-making, how individuals evaluate information, how they don't, how they're overconfident in certain things, whether it's airplane crashes or, as I often mention, the example of Chernobyl. There, truly expert individuals, the best globally at managing those nuclear power plants, had good analysis tools, but they consistently made wrong decisions from one situation to another. They weren't overruled by the machine; they overruled the machine, leading to the catastrophe. I believe, regardless of the nuclear power topic, this interaction between human beings and machines is extremely complex, and it's experiencing disruption through this AI topic. However, the target state in this balance, whether one understands the machine or not, has control over the machine or not, I believe it must always be present. But it's like a race, where the AI topic is advancing very quickly, and humans need to figure out where they stand, what their role is, what they can do, what they want, and where they want to go. Almost from a philosophical perspective, I

would see it that way—this competition exists. Because humans also have a certain function, a certain purpose; they don't want to replace themselves. So, there's a contradiction that you notice throughout the entire interview. We still, from my perspective, have sovereignty over much, can automate many things, can automate controls, but who controls the automation, who controls the machine? Probably, there still needs to be someone who simply observes what is happening. So, we need a kind of technology impact assessment, critical for the entire issue. You see it, for example, in algorithmic trading, where very strict controls are needed to ensure that, even if the machine is trading, what are the volumes, how much are we trading in the market, are we always trading up to a certain percentage in the market so that we don't manipulate the entire market. In short, perhaps I have a biased opinion as a risk manager, but we always need to know precisely; we must understand the machine and always know what it is doing. But it is also not an enemy, that is clear, I believe. We need to let go of that notion. Instead, we need to understand how it can help us and where it cannot. That is somehow important because crisis management also involves humans. When there is a flood, what does AI help with? People need to be saved, so there are very different parameters where one can rely on it or not. But I keep thinking of this Chernobyl example, where essentially everything was in place—the measuring instruments worked, there was no measurement error. The error was essentially in operating the machine and the element of overconfidence. People thought they were smarter and cleverer than the machine, but they were not. A crucial point, perhaps to differentiate a bit, what kind of crisis are we actually dealing with, natural disasters or a poorly functioning system in that context? Exactly, and that humans, in some form, are fallible and also make flawed decisions. Super, perfect. Does that go in the right direction?

Julia Steyer: Yes, that definitely helped a lot for the understanding. Thank you once again for the time!

Original:

Julia Steyer: Dann starten wir einfach mal und vorab wäre es einfach klasse, wenn du mir einen kurzen Einblick über eure organisation und deine Rolle im Unternehmen sagen kannst, einfach so eine kurze Einleitung und auch inwiefern du Touchpoints mit dem Thema KI oder Krisenmanagement hast.

E9: Also ich bin im Risikomanagement tätig für eine ja international tätige Bank im Brexit-Kontext. Wir haben ungefähr 1200 Mitarbeiter, nicht Mitglieder, Mitarbeiter. Ich bin selber Head of Operational Risk. Das umfasst ja auch das Resiliensthema und der Kontext letztendlich zu dem Thema ist, ja wir handeln jeden Tag sehr große Datenmengen. Wir haben sehr, sehr heterogene Daten. Das Thema Operational Risk geht halt von der natürlich auch Pandemie zu Kontaktthemen, zu Technologie, zu Outage, zu Prozessfehlern bis hin zu Betrug. Also in meinem Feld in dem Risikobereich ist sehr divers, sehr groß und hat sehr, sehr viele heterogene Daten. Ja, also selbst Indikatoren oder Daten, die wir jeden Tag lesen, messen, auswerten. Da kann ich immer wieder nur betonen, vergleich zu Credit Risk oder Market Risk, kann wir da in Operational Risiken sehr großen, sehr heterogene Datenhaushalt.

Julia Steyer: Super, verstehe. Um das Ganze jetzt mal so ein bisschen auf einer Skala festzulegen, wie würdest du denn da jetzt, sag ich mal, an Betracht auch eurer Unternehmensgröße und der Branche so die Technologiebereitschaft so von einem Level von eins, okay, Grundprinzipien irgendwie dargelegt oder auch so die Anpassungsfähigkeit, wie würdest du die einschätzen? Von eins bis zehn oder wohin geht's? Eins bis zehn.

E9: Also wir sind ja schon, also bevor ich das Rating sage, vielleicht was wir haben, was Banken generell sehr gut haben, sind erst mal viele Datenmengen. Also viele Datenmengen in der Tiefe,

dann sehr heterogen, was ich ja auch sagte und dann auch Datenmengen, die wirklich sehr komplex sind. Also viele Datenmengen und auch in der Tiefe wirklich sehr tief auch analysierbar, vielleicht für die Skale, für meinen eigenen Arbeitgeber, für den aktuellen würde ich sagen, wir sind ja vielleicht bei einer Acht und was fehlt zur Zehn ist im Prinzip Kontextualisierung. Also das schwebt mir eigentlich vor, auch ohne das, als wir vorhin gesprochen haben, also was letztendlich noch fehlt oder was so die Spitze des Eisbergs ist, das Sahnehäubchen vielleicht ist, dass man diese ganzen Daten halt kontextualisiert auswerten kann. Ja. Dass man sich nicht nur auf Parameter A konzentriert oder Parameter B, sondern dass die Parameter miteinander lernen zu sprechen. Und die einem dann als Risikomanager so eine Art Risikoradar geben, aha in dem Bereich haben wir ein Problem, weil jetzt in, ich weiß nicht, in einer Location in Europa immer häufiger der Strom ausfällt, haben wir da halt offensichtlich ein Risiko, aber wie kann man das kontextualisieren, vielleicht mit anderen Daten, ja, dass man im Prinzip eine bessere Vorhersagbarkeit hat. Also Datenmengen sind da, die Daten müssen besser miteinander sprechen. Ich kann das letztendlich als Mensch gar nicht miteinander verknüpfen, da muss uns die **Technik helfen, dass die Daten miteinander sprechen lernen**, dass dann eine bessere Risikovorhersage stattfinden kann, das wäre eigentlich meine Antwort dazu.

Julia Steyer: Okay, super. Ja, das geht jetzt schon so ein bisschen meine zweite Frage über. Also wenn du sagst so Thema, das und das fehlt einfach noch, um da wirklich auch den, sage ich mal den technologischen Fortschritt auch in gewisser Weise zu nutzen, gibt es denn, wenn du jetzt so ein bisschen auch die Phasen, du hast jetzt eben auch schon von Früherkennung gesprochen, wenn du jetzt so diese Prozessphasen ein bisschen betrachtest, sprich, Früherkennung, dann irgendwie strategische Entscheidungsfindungen, so eine Art Leistungssteuerung und Kontrolle bis hin zum, okay, organisatorisches Lernen, wie lerne ich aus einer Krise, welche Einschränkungen oder Herausforderungen siehst du denn gerade noch so im Thema Krisenmanagementprozesse oder auch so in Bezug auf Informationsverarbeitung, Zeit- und Kostenfaktoren.

E9: Also vielleicht kannst du da noch ein bisschen genauer werden. Also dadurch, dass die Daten halt, dass wir sehr heterogene Daten haben, die sehr breit sind, wenn ich das mal so sagen darf, gibt es im Prinzip, also fehlt es auch so ein bisschen an der Zentralisation dieser Daten, dass man so ein Portal hat, Portal-Lösung, wo das alles zusammenkommt, denn man kriegt vielleicht bestimmte Emails zu einem Thema, das da ein Indikator jetzt irgendwie statt gelb oder, sorry, statt grün, gelb ist oder rot, gibt es halt dann nur Single Track Notification Channels, ja. Also wie gesagt, Kontextualisierung spricht ja die Daten miteinander zu verbinden an. Man müsste vielleicht auch die Daten natürlich erst mal in gemeinsame Datenhaushalte parken und da verlassen wir uns jetzt bezüglich der Kommunikation natürlich auf die Tools an sich, dass man die auswerte, dass die aber auch bestimmte Dashboards dann haben oder wir verlassen uns auf Email-Based Alerts. Aber das muss man differenzieren. Pro Tool, pro DatenSilo ist das halt ein Weg, da gibt es keine richtige Harmonisierung. Also es wird alles noch sehr viel manuell natürlich auch gemacht, sehr viel manueller Aufwand in Excel und in Powerpoint, um dann diese Früherkennung irgendwie aufzubereiten. Dann hat man natürlich aber am zweiten Schritt, weil man ja bestimmte Indikatoren kennen, sind wir schon natürlich auch in der Lage, das zu automatisieren und sagen, okay, diese Indikatoren, dieses Set, dieses Dashboard, das hätten wir gerne jeden Monat. Also da gibt es schon institutionalisierte Prozesse, die aber auch relativ langsam sind, nicht zu sehr agil und auch nicht besonders punktiert bezüglich Eskalation. Man muss sich auch dann der Senior Manager in Tools einloggen, bestimmte Abfrage starten. Also im Prinzip fehlt eigentlich so ein Autocockpit, Geschwindigkeit, Benzin, Höchstgeschwindigkeit, Drehzahl, Thermometer oder Temperatur des Motors in diese

Richtung, dieses Cockpit, diese Cockpitvision, die hätte ich halt gerne, dass man das besser dem Senior Management transparent machen kann, wenn man sieht, oh, wir haben ein Problem in dem und dem Land, dass man da reingehen kann und dann kontextualisiert Daten zu diesem Sachverhalt sieht. Also partiell ist es da, es muss konsolidiert werden in Dashboards, in ja so Radarsystem, Risikoradarsystem und maschinelles Lernen, da habe ich keinerlei Exposure, also ich glaube nicht, dass diese Systeme so advanced sind bei uns, dass sie das schon können.

Julia Steyer: Ja gut, das wäre jetzt meine nächste Frage auch gewesen. Irgendeine Form schon sagen kannst, welche Tools in der Form jetzt bei euch irgendwie genutzt werden, um da so ein bisschen spezifischer zu werden.

E9: Also wir nutzen letztendlich Datenbanken, wir nutzen browserbasierte Dashboards, Tableau, ja ist da ein Einstichwort, das geht halt dann über Excel-Pivot-Tabellen hinaus, Mischung aus Excel und Access, wo man sich halt dann eigene Abfragen zusammenstellen kann. Aber das ist halt auch alles, es braucht irgendwie eine gewisse Bedienerfahrung, das ist jetzt auch nichts, was sich einem Senior Manager hier geben kann und dem Vorstand und sagt, klickt doch jetzt bitte mal selber ein Excel zusammen, also es braucht natürlich immer eine Definition, ein Stabpunkt, exakt, dass die Key Data Points, die Key Data Parameters erkennbar sind, erklärbar sind und dass man dann, dass es im Prinzip intuitiv ist, dass man da auch selber in die Daten reindrillen kann, sei es jetzt Region, Produkt, Mitarbeiter, wie auch immer man das dann in der Tiefe analysiert, da so ein Self-Service zu haben, der adjustierbar ist nach der Fragestellung von einem VP, von einem Vorstand, von einer Analystin, dass das so kalibrierbar ist in der auswertbar Fähigkeit oder auch unbedingt zum gesamten Vorstand zu gehen oder im Aufsichtsrat, da das sind Verhalten noch weg, das sind halt alles noch teilweise manuelle Prozesse, wo dann auch PowerPoint natürlich bedient wird.

Julia Steyer: Okay, verstehe, siehst du denn in dem Zusammenhang auch trotzdem irgendwelche Potenziale und Vorteile von AI-Implikationen, im Krisenmanagement, auch jetzt so broad gesprochen, generell gesprochen, gar nicht jetzt unbedingt jetzt in deinem Unternehmenssetting, aber irgendetwas, was du sagst, okay, da ist definitiv bedarf, da oder das könnte zielführend sein.

E9: Ja, so die, ich habe zum Beispiel ein ganz kleines Team und da habe ich ganz begrenzte Ressourcen und wir verwenden quasi doch noch immer relativ viele Ressourcen, das Problem erst mal zu identifizieren, um uns dann in der Tiefe zu analysieren. Wenn man diese Identifikationsphase quasi dem Algorithmus überlassen kann, der Maschine, dann kann man dann halt spezifiziert Fragen stellen an das Problem, ja, im Wohltrast ist auf, es ist ein wiederholtes Problem und so weiter und da stiftet eigentlich der Mensch natürlich noch den größten Mehrwert, weil er dem Vorstandern erklären kann, okay, es ist repetitiv, es ist nicht repetitiv, was ist eigentlich das Problem? Es braucht halt immer einen gewissen Anlauf wie beim Skispringen, die Chance, also es geht nicht darum nur gut zu springen, sondern man muss auch den Sprung gut vorbereiten und da haben wir halt einfach, da fehlt es uns einfach so an automatisierten Werkzeugen, dass wir eher in diese Analyse, in diese Deep- Dive-Phase halt einsteigen können. Ja, weißt du so was ich meine, da könnte, da würde uns, da kann uns nur die Technik unterstützen, da muss sie uns noch wesentlich besser unterstützen, dass wir dann halt das Kontextualisieren und quasi das Geschichten erzählen und bestimmte Events herum, dass wir das dann halt machen können, dass wir uns darauf fokussieren können.

Julia Steyer: Sehr gut, dass du das jetzt gerade angesprochen hast, vielleicht in dem Zusammenhang, wenn man den Spieß so ein bisschen umtrifft, welche Fähigkeiten und Ressourcen braucht denn jetzt eine Organisation oder auch vom menschlichen, von der menschlichen Seite her, muss denn bereitgestellt werden, um eben im KI eben effektiv im Krisenmanagement- Prozess in irgendeiner Form zu integrieren.

E9: Also, naja, so, das braucht erstmal die eigene Fähigkeit, **dass man diese Tools auch akzeptiert, dass man sie auch erstmal versteht**. Also ich glaube, da bin ich selber wirklich ganz ehrlich, ich bin da in gewisser Art und Weise schon ein Technologieskeptiker, was mir immer alles verkauft wird und wie immer alles funktioniert. Schlussendlich ist es eigentlich nur das Verbinden von Datenbanken und darauf kluge Fragen zu stellen. Aber also es braucht erstmal **Verständnis dafür, wie die Algorithmen dann letztendlich funktionieren**, was sie können, was sie nicht können, ja, auch sehr wichtig. Und dann braucht es natürlich auch Leute, die das oder Prozesse, die das enablen. Also nur weil ich jetzt hier bin in dieser Organisation, weil ich da vielleicht ein rudimentäres Verständnis habe, heißt es noch lange nicht, dass ich das irgendwie anwenden kann. Also es braucht auch einen **Enabling-Prozess durch Consultants**, durch vielleicht universitäre Info-Geber wie du, dein Team, ich weiß es nicht, dass das im Prinzip erklärt wird, dass auch Kontextualisierung nicht in der eigentlichen Analyse stattfindet, sondern Kontextualisierung stattfindet. Was kann eigentlich AI und was kann sie nicht? Ja, ich glaube, das ist immer noch eine schwarze Blackbox und das ist vielleicht neben den technischen Hürden der **Kapazität, weil sich die Stromverbraucher** und so weiter ist, glaube ich, dass die allererste Hürde, dass wir erstmal das Verhalten der Menschen anpassen können und sagen, okay, wir können aber für diesen Prozess AI nutzen, dass ihr euch dann auf B statt A konzentriert. Und da müssen wir irgendwie auch an die Hand genommen werden, dass kein Selbstläufer. Klar, verständlich. Ressourcen, also es braucht da wie gesagt diese Enabler, braucht vielleicht auch ein bisschen Zeit, um das selber zu verstehen und zu durchdringen.

Julia Steyer: Also es muss da im Prinzip ein Austausch stattfinden, dass man sich diesen Techniken öffnet und dann halt zu verstehen, okay, wie kann man das jetzt im Daily Use eigentlich einbauen?

E9: Das ist glaube ich ganz wichtig. Verstehe. Und Fähigkeiten natürlich auch vielleicht irgendwie. Ich glaube jetzt nicht, dass wir coden müssen, also people who can code ist ja ein riesiger Demand im Markt, aber ich glaube nicht, also das Senior Management ist dazu sowieso nicht in der Lage, ja auch keine Ahnung, das mittlere Management ich selbst vielleicht auch nicht, aber da brauchen wir wieder die Enabler, die sich dann halt um die Fragestellung kümmert, wie im Physikunterricht gegeben, gesucht, Lösung. Wie kommen wir denn jetzt zu der Lösung und wie hilft, wie konkret hilft uns das AI-Thema da? Ich glaube das ist vielleicht die Kernrolle der nächsten zwei, drei, vier Jahre.

Julia Steyer: Ja, verstehe. Also würdest du auch schon sagen, so ein gewisser Insight auch so ein bisschen zusammenbringen von eben auch Anforderungen und von Führungsqualitäten vielleicht auch, auch dem Top Management, dass dann halt eben, du hattest eben vorhin eben kurz angesprochen, eben auch das Mindset auch, der will es ein bisschen da, sich mit AI irgendwie vertraut zu machen, die Tools in irgendeiner Form auch zu akzeptieren, da eine Lösung mitunter auch zu sehen und dann halt eben auch das Skills und das Knowledge zu haben, das Ganze eben auch durchzuführen. Ganz genau. Und dann vielleicht auch bestimmte Examples dann zu zeigen, was vielleicht auch so Industriestandard ist, weil ich glaube da sind die Banken auch sehr unterschiedlich unterwegs, dass man da so eine Benchmarking-Analyse macht, wo wird das denn jetzt eingesetzt?

E9: Und dann ist es natürlich auch so,vielleicht einen Aspekt haben wir noch gar nicht berücksichtigt, das ganze **regulatorische Thema**. Wir werden ja auch dahin gehen, zum Beispiel geprüft. Wir können jetzt ja nicht einfach irgendetwas implementieren. Wir müssen ja immer genau diesen, diesen Connects aufzeigen, zum Beispiel bei Kreditentscheidung, selbst wenn das eine Maschine macht, eine Kreditentscheidung müssen wir immer in der Lage sein zu erklären, wie anhand von welchen Parametern die Maschine das trifft. Das heißt, wenn ich jetzt etwas implementiere für das Risikomanagement, für Resilienz, muss ich dem Regulator auch immer sagen, okay, also wie sind die Parameter der Maschine, dass sie mir auswirft, oh, wir haben einen High Risk in dem Business und in dem Land. Also es muss letztendlich auch Transparenz sein, wie das funktioniert. Das ist sehr wichtig, weil ansonsten nicht klar ist, Vollständigkeit ist nicht sichergestellt, da gibt es vielleicht einen gewissen Baies, den man dann als Management selber vielleicht auch nicht sieht und dann Fehlentscheidung trifft. Ich glaube, das ist sehr wichtig. Und das zu Evidenzen für die gesamte Szene, sage ich mal, für die gesamte Branche, ich glaube, das ist vielleicht auch eines der Kreatorien. Um diese Akzeptanz zu schaffen auf der Benutzerseite, wie auch auf der regulatorischen Seite. Weil das nur zu fordern hilft nicht, ich glaube, es muss auch funktionieren. Also es muss in dem Maße auch quasi irgendwo vorhersagbar sein, sage ich mal, dass was gesagt wird, was das kann, die Capability, die Ability, dass das dann auf die PS auch quasi auf die Straße gebracht werden. Und es ist nicht nur eine Wurthöse bleibt oder eine empty Shell.

Julia Steyer: Weil du das vielleicht gerade angesprochen hast, so Thema Regulatorien und so weiter, dass das Ganze auch sich in irgendeiner Form etabliert, dass das natürlich auch gelingt ist mit Richtlinien und so weiter, gerade jetzt auch in Bezug auf größere Unternehmen und wo halt auch große Datenmengen in irgendeiner Form und sensibler Daten auch im Umlauf sind. Gibt es denn in irgendeiner Form gerade auch, was KI unbedingt ist ja immer so die Frage Datenschutzbedenken und Datenschutzimplikation, dass du jetzt selbst schon mal mit dem Thema in irgendeiner Form dann auch, dass du dann irgendwie Kontaktpunkt, also so Berührungspunkte mit hattest und was sind denn mögliche Lösungen oder irgendwelche Bewerten Praktiken und gerade auch dieses Problem irgendwie ein bisschen entgegenzuwirken.

E9: Also das Thema Datenschutz und Data Protection Information sicherheit ist sehr, sehr groß. Es wäre jetzt gelogen zu sagen, ich habe da jetzt schon Touchpoints gehabt. Ich prognostiziere jetzt anhand des Interviews, was sind so die möglichen Issues, die wir hätten, wenn wir das jetzt implementieren in einer riesigen Scale, wie man das halt verteidigen müsste. Ja, ich glaube es ist halt ein Parameter, der berücksichtigt werden muss bei der Sache, wie man dann halt mit diesen Daten letztendlich umgeht, wie man die Daten dann schützt, wo die Daten aufbewahrt werden, Cloud, nicht Cloud, unsicheres Drittland und so weiter. Also das muss als ein Analyseparameter klar sein, wie die Daten letztendlich eigentlich geschützt sind und wie die Handhabung der Daten eigentlich ist und auch der Schutz der Daten. Da ist Deutschland sehr strikt im Vergleich zu anderen Ländern durch diesen besonders hohen Anspruch. Da muss es im Prinzip auf diese Fragen auch konkrete Antworten geben, die verlässlich sind, wie das dann exakt genau funktioniert, wie die Maschine dann damit umgeht.

Julia Steyer: Okay, dann vielleicht um kurz nochmal so eine abschließende Frage dir zu stellen und vielleicht auch mal so deine persönliche Einschätzung noch mal zu hören. Wie siehst du denn die Entwicklung, also hinsicht des Future Outlook und Thema Rolle KI im Krisenmanagement und klassische Frage auch, wie siehst du das Ganze in auf AI eben auch den Menschen irgendwie replacen kann, gerade auch in Bezug auf Resilience Crisis

Management und vielleicht auch Integration von KI System, wo du sagst okay, da ist definitiv Potential da und das könnte man in irgendeiner Form etablieren und einbinden.

E9 : Lass mich mal kurz nachdenken. Genau, also letztendlich, wie soll ich sagen, es ist fast schon philosophisch, es ist natürlich wünschenswert, wenn man die Schwächen des Menschen, des decision making, des human decision makings ausmärts durch AI. Also das ist ja im Prinzip, wenn wir alles durch Maschinen steuern könnten, ist das vielleicht ein ideal typischer Zustand und es muss auch in diese Richtung gehen, dass wir die Automatisierung vorantreiben, dass wir die Daten nicht mehr nur quasi manuell, singulär, nicht kontextualisiert betrachtet, irgendwie analysieren. Also da in diese Richtung muss es klar gehen, weil die Datenmengen, die wir haben, einfach nicht mehr handhabbar sind. Also das ist klar, aber zum anderen bin ich als Risikomanager, sage ich immer wieder, auch immer in Vorlesungen, Banks need to understand and have proper control over their machines. Das ist das, was ich sagte, nicht nur der regulatorische Punkt. Wir müssen bei all dieser Fantasie immer verstehen, was die Maschine eigentlich macht und wir müssen uns dafür auch teilweise rechtfertigen bei den Regulatoren, dass die Maschine das, was sie macht. Wenn wir Interviewprozesse haben, wenn wir Kreditentscheidungen treffen und sonstige Entscheidungen oder Krisenmanagement. Also wir müssen im Prinzip da ein fides Werkzeug schaffen, was wir den Menschen an die Hand geben, damit sie sich halt noch besser und souveräner in Krisensituationen halt leiten lassen können. Dann ist immer viel Hektik, viel Emotion. Da braucht es halt auch ein analytisches Verständnis und Toolkit und dafür braucht es halt diese AI. AI muss auch an sich immer kontrolliert werden, deswegen darauf, aber das hatte ich eigentlich auch schon gesagt, dass es repetitiv letztendlich, genau also in dem Maße sehe ich das. Also ein großer Schwachpunkt ist natürlich halt einfach immer der Mensch, der Menschen der Entscheidungsfindung, wie ihr Informationen bewertet, wie ihr sie nicht bewertet, wie ihr overconfident ist bei bestimmten Sachen, sei es bei Flugzeugabstürzen oder ich sehe immer wieder das Beispiel von Chernobyl, wo wirklich Experten, dass man die weltweit besten Leute, die diese Atomkraftwerke gemanagt hatten, die hatten glaube ich auch gute Analyse Tools und so weiter, aber sie haben sich konsequent von Situation zu Situation einfach falsch entschieden. Und da wurden sie auch nicht von der Maschine overruled, sondern sie haben die Maschine overruled und dann gab es die Katastrophe und ich glaube, unabhängig von dem Atomkraftwerksthema, so diese Interaktion, Human Being und Maschine, die ist extrem komplex und die erfährt jetzt Disruption durch dieses AI-Thema, aber was so der Target State ist in dieser Balance, ob man die Maschine versteht und nicht, du wirst auf die Kontrolle über das Maschine oder nicht, ich glaube, es muss immer gegeben sein, aber es ist wie so ein Wettrennen, dass jetzt das AI-Thema natürlich sehr schnell auf die Straße kommt und der Mensch muss natürlich gucken, wo bleibt er da an der Stelle, ja, also was ist seine Rolle, was kann er, was will er und wo will er hin, also so, fast schon aus philosophischer Sicht würde ich das eigentlich so sehen, dass es da diesen Wettkampf da eigentlich gibt, ja, weil der Mensch natürlich aber auch noch eine gewisse Funktion hat, einen gewissen Purpose, er will sich auch nicht selber ersetzen, also das ist so ein Widerspruch, der eigentlich du merkst in dem ganzen Interview immer kommt, dass man natürlich immer noch aus meiner Sicht die Hoheit darüber hat, vieles automatisieren kann, man kann natürlich auch Kontrollen automatisieren, bloß wer kontrolliert die Automatisierung, wer kontrolliert die Maschine und da braucht es dann wahrscheinlich doch immer noch jemanden, der einfach schaut, was da irgendwie passiert, ja, also man braucht einfach so eine Technikfolgenabschätzung irgendwo auch kritisch für dieses gesamte Thema, ja, du siehst es zum Beispiel beim Thema algorithmischer Handel, auch da braucht es ganz strikte Kontrollen, dass wir sehen, okay, selbst wenn die Maschine handelt, was sind die Volumina, wie stark handeln wir im Markt, handeln wir immer nur bis zu einem bestimmten Prozentsatz im Markt, dass wir nicht den ganzen Markt manipulieren können, ja, also kurzum, vielleicht habe ich da jetzt eine gefärbte Meinung als

Risikomanager, aber wir müssen immer genau wissen, wir müssen die Maschine verstehen und immer wissen, was sie dann tut, ja, aber sie ist auch kein Feind, das ist auch ganz klar, glaube ich, da muss man sich auch lösen, sondern wir müssen verstehen, wie sie uns helfen kann und wo sie es eben nicht kann, ja, das ist irgendwie, glaube ich, ganz wichtig, weil es Krisenmanagement umfasst dann irgendwie Schluss auch den Menschen, wenn Hochwasser ist, was hilft einem da, die AI, dann müssen Menschen halt gerettet werden, also es gibt ganz unterschiedliche Parameter da, wo man sich darauf verlassen kann oder nicht, aber ich denke immer wieder an dieses Chernobyl Beispiel, wo im Prinzip an alles da war, die Messinstrumente haben funktioniert, es gab keinen Messfehler, der Fehler war im Prinzip die Bedienung der Maschine und das Element von Overconfidence, dass Leute dachten, sie sind smarter und cleverer als die Maschine, waren sie aber nicht. Total, also wichtiger Punkt, dass man vielleicht auch so ein bisschen differenziert, so was für eine Art von Krise handelt es sich überhaupt so, sprich Naturkatastrophen oder eben ein schlecht funktionierendes System in dem Zusammenhang und genau, dass Menschen in irgendeiner Form halt doch auch gebeierst sind und auch Federentscheidungen treffen, ja super, perfekt. Geht das so in die Richtung?

Description of interview situation:

Location: Online

Interview recording: Microsoft Teams conference recording was used to secure the data. Thanks to a quiet environment, high-quality audio files could be generated here. These can be accessed via the following link:

Short description of the atmosphere

Duration of Interview: 28min

Feedback:

Appendix 5.10: Expert 10

Transcript for the expert interview

About the master thesis *"Artificial intelligence in crisis management - an analysis of potentials and limitations to enhance top management responses as part of business resilience."*

Name: E10

Company: Anonymous

Position: Crisis Management Risk Officer

Email address: Anonymous

Interviewer: Niklas Mauer

Date: 06.11.2023

Interview Objective:

This survey aims to facilitate dialogue among crisis management, AI experts, and Nova SBE students. In doing so, an exchange of information will take place that targets the topic of "Artificial intelligence in crisis management."

Niklas Mauer: Hi Luca, as a start, could you briefly describe your role and tell me something about the company you're working in and about the touch points you have with AI and crisis management.

E10: OK, so I work for BNP Paribas, which is one of the most important banks worldwide present in most of the countries across the world. And inside this group I am the group crisis management risk officer, which means that globally I am part of the second line of events. I don't know if you are used to the three lines of defense or security. You have risk management in the first line and business continuity in the third line. And I am in the second line of defense risk management, which means I am the police of the police which means that you have different a crisis manager operational resilience manager globally. And I must check if what they are doing in undertaking crisis is good if they are following some best practice, regulations and so forth. My role is a global crisis and management risk officer is inside what we call the operational resilience team. So inside Anonymous you have the operations resilience team and it's composed of five pillars, and these pillars are business continuity, cybersecurity, IT resilience, third party management and crisis management.

So my role, it's pretty much to intervene when an incident become a crisis or when business scenario is, wrapped into a crisis, it becomes a crisis because of several aspects such as impacts, shows, reputation and so forth. So OK, so my role is to understand to face this kind of crisis in a reactive point of view, but also from a preventive point of view, because I'm in a risk management. So my role is also to analyze what could happen to the bank in terms of threats of risks and in terms of black Swans, which are, particularly variable that no one says undertake. But I think that if you read Nassim Nicholas Taleb you can know what the what is a blank spot.

Niklas Mauer: And maybe as you described, it sounds that you are pretty large team in crisis management or within the whole organization.

E10: Not at all, because each country has its own crisis manager local. So you have some banks in Europe that are part of the group BNL in Italy you have 40s bank in Belgium you have BNP retail bank in France and each of these entities has as is own crisis manager from the first line

and it's own operational resilience team and it's own operational resilience managers on the second line of defense. And my job is to coordinate globally all of this. These people you know in in writing, not only the policies, the guidelines, the methodology, but also in check and challenge them, which is one of my the biggest part of my job and in monitoring what happened in understandings in order to in understanding in terms of lesson learned what happened in terms of incidents that become the crisis and yes to go and of course taking part to the stress test that could be part of requested by the European Central Bank by Bank of America by Bank of England Bank of Hong Kong and so forth and so on for example. We regard all the financial services industry, so this is only to for you to understand better my job than and what I do.

Niklas Mauer: Thanks, that will help me to put it into context later on and maybe to summarize the background information. To continue, could you rate the BNP bank on the technology readiness level?

E10: Considering your work environment well, I cannot answer regarding my company, because we use tools that are developed directly by us. What I can answer you is it depends from legal entities to legal entity. So you have to imagine being as a huge federation such as European Union. The tool that BNP Europe is using, the tool that BNP American branch will choose, it's up to them. OK, so to answer you to you, yes, some of them use artificial intelligence and some of them use outsourced services for example Service Now, Rectec Open Project, Alert Media, Everbridge all the tools that you can imagine regarding crisis management. But from a group point of view, we don't have a specific guidelines regarding this except from artificial intelligence, which is pretty much a central point for us. But I cannot answer to for to from this part.

Niklas Mauer: So what you're saying for AI is you have a general group approach and artificial intelligence is kind of involved into that approach.

E10: Yes, starting to get involved.

Niklas Mauer: That's also great to hear someone who's already working on it, because at the moment we have a couple of interviews and they were saying, they can imagine it and they see huge potential, but at the moment there's nothing in place. So could you maybe highlight a little more the limitations or challenges in the crisis management process and where AI could help to solve these issues.

E10: Well, of course it depends on the issue. Crisis management a don't need artificial intelligence. Crisis management need the experience of the crisis manager. In terms of knowledge of the organization, in terms of connection of network that he has inside your organization and outside your organization and psychological resilience. These three points don't need artificial intelligence.

I see the implication of artificial intelligence more in a preventive phase of crisis management for example to undertake an analyze of black swans, risks, threats in order to, thanks to big data, analyze what could happen. But when it happens immediately. I see artificial intelligence in a very skeptical way, because I think that it might be a for now a useless tool that cost a lot of money when in fact it requires only the knowledge and the experience of the crisis manager, why so? Because it might be useful if you have to undertake all the regulation and the timing of notification to regulators and to understand, I don't know the mapping of your organization understanding, this tool, this software is compromised and it has interdependencies without a

process. And there are already tools that doesn't use artificial intelligence that do so. But let's choose a particular crisis. I don't want to use ransomware because it is very particular and you are basically fucked if it happens.

Let's choose an internal leaker that decided to stole data to sell them to a competitor. The DLP tool cannot block, every email, every document that you send outside to avoid it, because otherwise the business can be compromised. What you do? Artificial intelligence in that case might be completely useless because it is a problem of human resources. It is a problem of legal it is a problem on how to suit the guy and in understanding if he has malicious intentions. Does he want to sell the documents or it is only because he wants some PPT and excel and doesn't want to repeat them and to copy paste in this his next work. So artificial intelligence useless. Let's talk about natural disasters. AI can help in a preventive way in order to analyze how many times a threats happen. So the lihood enough particularly stopped period when that happens when you have a flood, when you have an earthquake, when you have a fire, you can have all the business continuity plan, all the crisis management plan, all the tools used. But no one, and this is really funny. Niklas. No one has ever undertake one thing. The fact that in the city you have a family, so if a earthquake or tsunami happened in Lisbon, for example, you don't give a shit, as they cannot pay it and as you just want to save your family. So you come back at home, save your family. So artificial intelligence in that case, cannot be very useful, you do not care. You underestimate the psychological factor of a crisis, OK?

Niklas Mauer: Yes, because the human factor always plays the larger role or emotions are getting more important than money or worrying about the business.

E10: Exactly. Let's take another example where it might be useful. On 7 October Hamas attack Israel only a few people know that it started with a cyber attack on the Israeli infrastructure. So artificial intelligence or OP tool could have blocked this kind of attack and immediately alerts all military, the soldiers to protect from terrorist attack. And that's artificial intelligence could be useful, but after that? No, because let Hamas was able to enter Israeli and took it that people and to kill people.

Niklas Mauer: So if you would be trying to match it to a framework, say you have a prediction phase kind of where you do the simulation prediction, then you have a decision making phase where you actually decide what to do and then you have your crisis response where you solve communication internal, external and maybe some performance measurement about the actions you took and in the end organizational learning. Would you say there are specific use cases for AI in each phase or only in prediction phase?

E10: Sorry to interrupt you, but you are maybe mixing few things. The performance measurement is very useful as you as you said, but it's in another phase. It's not crisis management it is in lesson learned. So only after few hours or a few weeks you will be able to understand what happened. I don't know if you know the diagonal cycle, the plan, do, check, act. It's useless in crisis management. I prefer the olda loop. Orient, observe, decide, act. It is a concept that was stated and maybe it would be useful for your thesis by the Colonel John Boyd for of the American Air Force and I highly suggest you to study the olda loop in order to understand what is in fact crisis management instantly. In addition, you have the lesson learned with the key measurements and there you can use artificial intelligence in that sense to understand what happened, to understand what were the mistakes that should not happened again and in order to understand the lesson learned you could use in a preventive phase.

Crisis management is distant to crisis and can be of two types, instant, and creeping. Suddenly you have a crisis or it can slowly grow and happen. In that sense, you have to be extremely reactive, but as a person, in order to have a proper decision making and to take the correct decision immediately. So you could use a dynamic threat model and Defcon, with the sense readiness condition.

Niklas Mauer: Not that much. Could you explain it a little?

E10: It's the regarding the nuclear threat. Imagine you have different level of crisis and inside every level of crisis, you have some guidelines that you could provide to the crisis manager. So for example I have a scenario of distraction or unavailability of facilities of buildings, due to a float. OK, it compromises a lot of different processes, a lot of assets and so far. Then this is the decision. This is the information that I must undertake, for me to take the correct decision. But it's a guideline and artificial intelligence could help on that. But more important is the experience of the crisis manager. A lot of people create startups, a lot of people create tools that could help, in undertaking this dynamic threat model. But at the end, it is the crisis manager that has to decide.

Niklas Mauer: ja genua Yeah, this would have been my next question if you see potential to give support or for creating the guidelines or communication plans for example or if you could see some potential if you have the crisis management manager and he says OK we need to talk to our shareholders. Do you see some potential there just to automate tasks in order to focus more on the actual crisis management tasks.

E10: The question is that I consider it useful to integrate AI in the communication process? If so, the answer is yes, but it's not a proper answer because when you study crisis management in university, some professors say there is no crisis without communication and there's no communication without a crisis, right? It's important to have a good communication to undertake the good, to avoid every reputational impact and stuff. But in a bigger organization, you have the communication team that never works with the crisis management team, OK, we and they do sometimes completely different jobs.

Niklas Mauer: So what you are saying is that they publish some kind of generic PR statements without meeting with the crisis management team?

E10: Yeah, basically yes. If you have, I don't know someone that writes on X formally Twitter bullshit on your organization's OK could be a crack. AI here cannot be very, very helpful, because it is the threat to the craft, to the crisis manager or the crisis, or to the communication manager to choose the proper strategy to answer it.

Niklas Mauer: But could you see AI as a potential to support the activates like generating this statement and then the crisis manager chooses and adjust it?

E10: Yeah, exactly, exactly.

Niklas Mauer: And as we were talking earlier about the importance of the human factor, could you elaborate a little more about the skills that are needed for a good crisis manager?

E10: The knowledge of the organization's to perfectly know every process, every service, every activity and every an asset that they used inside the organization. I could see the capacity to

listen to the other. The rapidity in taking decision, and so it's a matter of responsibility of every single decision that it will take during a crisis and the liability. There a lot of we can use as objectives, but the first, the first skill that comes to my mind is the knowledge of the organization and of course of the internal and external context. OK, it has to be extremely resilient or antifragile to use the terminology, and also from a psychological point of view, the human factor to come back to your question is extremely important, extremely important. And fortunately, Niklas, because otherwise the machine, could undertake everything, and they could take very badly, you know, in terms of activity. And in the magic of a crisis there are a lot of psychological aspects that must be undertaking, diplomacy, politics. And that's extremely complicated. If you have lives in danger, I remember two years ago I work for a draining off and draining on oil extraction company and there was a fire. You could use artificial intelligence to predict to understand, to monitor what happened, the software and all the mechanical parts. But when the crisis comes up and when there is the fire, you have to mix this point security and safety together in order to save human lives. And in this sense, artificial intelligence could be useless.

Niklas Mauer: Thanks for that info, maybe could you summarize a little what potentials you see of using AI, and talk about disadvantages as well.

E10: The disadvantages we talk about it. AI also has a lot of advantages but in crisis management I see a few applications in terms of reactive and reaction. It could be very, very useful for dynamic threat model. But on a preventive point of view and on a lesson learned point of view, to calculate KPI, in order to establish new key right for the future and on a preventive point of view, to understand the, ooda loop in a very quick way, in order to integrate big data. The to understand the threat, the risk, the scenario to understand the black Swans. So these are the pros, OK? The cons is that during a crisis, in fact, it's completely useless.

Niklas Mauer: Could you maybe give one or more detailed example if it's possible for the organization development part for some actual use cases where you could see the potential besides the KPI measurement and improving based on the KPI analysis?

E10: I see two questions here if I'm not wrong, the first one I cannot answer to the use case of what happened. The second one regarding KPI. Can you repeat please?

Niklas Mauer: I talked with other experts and they were saying there is some potential of using artificial intelligence for KPI compiled and they're also highlight more of the role of crisis management by analyze the impact of avoided crises. Could you see benefits for this as well?

E10: Yes, artificial intelligence can help in that sense. Of course, the benefit can be the fact that you can react and analyze data very quickly, right? But it's not crisis management, it's business continuity. It's risk management. It's IT risk, it is IT governance, not crisis management, OK. To understand the scenarios in order to understand and mapping old yes it off on your organization in mapping all the processes in understanding all the software that supports the services that supports the processes. In that sense, artificial intelligence, it might be fundamental in order also to understand the trends of just the software in terms of incidents, this is fundamental analyzing threats that could lead after to a crisis or incident or series of incident that could lead to a crisis potentially. Yeah.

Niklas Mauer: And maybe just a few last questions. As you were saying, you are developing the AI software for your company within your organization. What is the reason behind it? Do you see privacy concerns or more like as you see it as a key asset?

E10: The AI software will have a lot of implication like blockchain, artificial intelligence, robotic process automation as we are using every new trend inside our organization. But I will not tell you more.

Niklas Mauer: Sad to hear that, but let's continue then. Do you believe that, the potential impact of AI on crisis management could increase or do you say as you mentioned the human factor is not replaceable.

E10: I think it will be a lot of different potentials, OK. But, I'm very skeptical because all of the reason that I told you, I mean, for me human factor is sent and in central in taking that decision also there is a I don't know if you know dark trace there is an example of of my script escape being skeptical that trace was cyber security tool that use artificial intelligence to detect any kind of threads OK. And it has a lot of a lot of different problems. And now I think it was also a lot of companies renounced through dark trace because there's a lot of problems. So yes, I am skeptical, but I hope that yes, it will be more useful in the future.

Niklas Mauer: Ok, maybe to round up the interview. You were talking about the black Swans earlier. Do you see some potential using AI in the prediction phase as well? Or would you say it's so unpredictable you cannot use AI?

E10: No, no, no. A Black Swan is analyzing something that that could happen and prevent in building security countermeasures before it happens. In that sense, artificial intelligence might be fundamental, in predicting the unpredictable.

Niklas Mauer: Yeah, I would like to challenge that a little further as we have some experts with different opinions. Some say AI needs to be trained on the past data. And therefore, it's kind of hard if it never happened to predict possible outcomes.

E10: True, but a crisis could not only be based on historical data. It is also based on random variables. OK, so you have this particularly distribution functions of random variables that could predict something OK with particular area algorithm so not only based on only on historical data, but only on trends. For example, you know what is the one of the biggest threats nowadays for the continuity for the IT continuity.

Niklas Mauer: I believe ransomware and hacking or it's electric supply.

E10: Yes, you are pretty close. One of the biggest threats, for example, in America are squirrels, artificial intelligence maybe could prevent this kind of problems. Solar winds, for example, are another threat that no one under the OR or very few crisis management and managers think of. OK. I think that artificial intelligence could help in predicting that.

But in the end could create all the possible calculation on the Earth to calculate their risk, but it will be the board of director that will decide if it is necessary to mitigate, to explore, to accept the risk, OK and most of the risk of course they are mitigated, but a lot of them are also accepted and we accept the probability that the likelihood that it could happen. Look at the coronavirus Bank of England undertake the threat of this particular scenario of the Pentagon scenario. Since

2005. OK, so we already knew that something could happen on that sense, but of course the likelihood was extremely, extremely, extremely low.

Niklas Mauer: Yeah, in the end it's all always the likelihood cost function. And we can't prevent everything because then we will run out of business because of bankruptcy. So we kind of undertake some risk.

E10: Yes exactly.

Niklas Mauer: As time is coming to an end. I wanted to ask you if there is anything you want to add.

E10: Well, I hope it was interesting for you and I hope to answer to your question even if I am blocked by some nondisclosure agreement. If you have any question, don't hesitate to contact me whenever you want on LinkedIn, I will help you be more than happy to support you. I think this is a great, great subject to their dive into from strategical point of view. I will point out, to be honest in your conclusion on the preventive and on the lesson learned side, one aspect that maybe we didn't get and we didn't talk about is the geopolitical factor for scenarios that are linked to that. The war, for example, air strikes, climate migrants and so forth and so on. Artificial intelligence can help on that. OK, so it might be very interesting for you to go more in depth on this arguments, but of course on a preventive point of view it will not be a crisis management point of view. What can become a crisis management, for example, in the when Russia declares war to Ukraine. They are attacking themselves, but in that way you have a crisis situation for banks as a bank can lose a lot of money because the letters a lot of connections with Russia. So you are in a crisis situation, but without any physical damage or economical damage, only potential economical damage. In order to calculate this kind of this kind of variable that what can happen if the word last three years, OK, this might be interesting.

Niklas Mauer: Thanks for providing these further thoughts and moreover thank you for your time and expertise.

E10: You are welcome, I would love to read the thesis when you will finish.

Niklas Mauer: What we offer to our experts is one hand you will receive the thesis and on the other the analysis that we use that you are able to draw your own conclusions and that you're not only limited to the thesis itself. So thanks once again for taking the time.

E10: You're welcome and thank you very much and good luck.

Niklas Mauer: Thanks. Bye.

Appendix 5.11: Expert 11

Transcript for the expert interview

About the master thesis *"Artificial intelligence in crisis management - an analysis of potentials and limitations to enhance top management responses as part of business resilience."*

Name: E11

Company: Anonymous

Position: Global Director Crisis Consumer & Excellence

Email address: Anonymous

Interviewer: Niklas Mauer

Date: 14.11.2023

Interview Objective:

This survey aims to facilitate dialogue among crisis management, AI experts, and Nova SBE students. In doing so, an exchange of information will take place that targets the topic of "Artificial intelligence in crisis management."

Niklas Mauer: Hello. So, hopefully, that works. It looks good. Yeah, it's good. That kind of thing. Regarding security, I totally understand. So, maybe, as it seems that you are a little short on time, I would suggest we start right in. Have you had the chance to have a brief look at the expert interview or the guiding questions? OK, perfect. And then it would be awesome if you could give me a quick introduction about your role, about the company. We will anonymize it, but it would help us to have some indications and also, maybe, about the technology readiness level, so to say, how much you work with tools or already with AI.

E11: OK, so I'm the global crisis manager here at Anonymous AG, and that means I'm responsible for any crisis that occurs in any area of the business. It's kind of everything from security, health and safety of people, and quality issues, withdrawals, recalls. So anything that potentially has a reputation or impact poses a risk, and the safety of our consumers, any kind of criminal charges, tax frauds, ethical, or legal parts. So this is the sphere that I'm responsible for within Anonymous AG. If and when it comes to AI intelligence, we don't use any type of AI intelligence right now for crisis training, planning, scenario planning, or on how to manage and respond to a certain crisis that we may have. The crisis management process is actually very new at Anonymous AG. So I think crisis management itself is not new to Anonymous AG. It's just that before it was very much a silo-based approach, so every department dealt with crises in their own department by themselves, and there was no overarching holistic program. And therefore, what can happen in terms like misinformation can get mislaid? Lessons learned are not followed up. Scenario planning is not done, and so forth. So last year, we launched a new holistic crisis management process for Anonymous AG, which kind of incorporated that on how to respond, act, assess, reevaluate every type of crisis that we have and even to monitor beforehand any crises that could potentially be on the horizon. AI at the moment has kind of had very much little to do with it because, as I said, we only just launched the process last year. But we did look at it very much from a technological point of view, how we could capture information. So when you're in a meeting, how do you move away from having an Excel file to capture minutes of a meeting and actions coming out of a crisis rather than having like a pen and paper minutes getting lost, actions getting lost? So this is something that we focused on, is what technology could help us capture that information. How could we assign tasks and how

we could respond? The other side of it is kind of the lessons learned as well, but go ahead if you have.

Niklas Mauer: Yeah, maybe two questions to go a little more into detail. So how would you describe the crisis management process at Anonymous AG? You mentioned that you have some phases of prediction, identification. Then there's probably some decision-making, some crisis response, and you also include the lessons learned, organizational learning part in your process, right?

E11: Yeah, yeah, that's exactly it. So, we have a five-step approach, and it's literally one is to monitor, two is to assess, three is to alert, four is to act. So, this is what we call the AAA approach on how we should act, assess, and alert within a crisis or how to respond to a crisis. And then we have the reevaluate part, which is literally we don't just reevaluate during the crisis itself. We reevaluate after the crisis has occurred. So, during the crisis, we always put in a reevaluation step, and that's our fifth step to kind of predict scenarios that we think could potentially happen or could be a consequence if we decide to take this action or this step.

Niklas Mauer: And are these steps similar for all kinds of crises you mentioned earlier? So, do you have them in place for security issues, but also for product issues?

E11: Yeah, exactly.

Niklas Mauer: And as you mentioned, you have some tools for kind of project management to handle tasks like manuscripts and try to automate these. Are there also tools in place for the prediction or for the other phases?

E11: For the monitor phase, that's the first phase that we have of our crisis management process, which is probably the most proactive or preventative part we have. In different departments, we have media monitoring, which involves scanning our global channels to understand what is being said about Anonymous AG using specific keywords. That's what we call media monitoring. We also monitor social media channels to see how local countries or local people are reacting. We have KPIs within the business that tell us what's on track and what's not on track. Additionally, we have a cybersecurity department with KPIs, such as the number of phishing emails and the frequency of targeting. In each area, we have specific monitoring KPIs or tools that contribute to our preventative measures. Another example is from a business perspective, where we have a business continuity KPI. So we look at whether we can source raw materials and assess if we would face a crisis in the market, preventing us from supplying to the business.

Niklas Mauer: And are there tools in place for decision-making, or does the decision-making come down to having some kind of preparation, different options, and then the task force handles the decision-making?

E11: No, the decision-making is really in what we call this AAA approach. The first step is that, because we're such a global company, a crisis can occur in any one of our affiliates globally. So the first thing is always to assess the action needed, and through that assessment, a response team is mobilized. We've created an A-contact app that enables local crisis manager representatives in a country to look at their contacts and see exactly who they need to call into making the first team, so to speak. Once they've done that and assessed the situation to understand the difference, if it's a severe crisis, then it's to alert myself as the global crisis

manager. That's a simple phone call—no technology involved, just a Teams call to inform me about the ongoing crisis and set up a meeting. We then have a discussion to understand the situation and decide if I need to mobilize a global team to support the local team. That's what we call the assess part. Then we act, meaning once we've established a local or global team to respond and manage the crisis, we use a logging app. In the meetings, I chair, together with the local crisis manager, I am the main logger who records all the actions. We use the Power BI app to capture all that information. The first thing we do is provide a description to make it clear for communication purposes what the crisis is. We look at the impact, describe the issue, show the impact in terms of potential loss, and perform a risk assessment. After that, we start capturing key events. These key events represent significant steps that happened within the crisis. Behind these key events, we enter tasks. The app is connected to Microsoft Planner in Teams, allowing the crisis team members to see their tasks, what was done, key events, meeting minutes, what they need to do, and what they should bring to the next meeting. Importantly, they can also see when the next meeting is scheduled. We use the Power BI app coupled with Microsoft Planner to manage information and tasks arising from a crisis situation.

Niklas Mauer: OK. To conclude the process from the current state, how are tools involved in the organizational learning part?

E11: So, we use what we call a CAPA, which stands for Corrective and Preventive Actions plan. After a crisis, we regroup and evaluate all the learnings and actions that could prevent a recurrence in the future. We apply simple theories, drawing from lean manufacturing principles like the KISS (Keep It Simple, Stupid) principle or the CAPA principle. Essentially, we sit down and discuss the key learnings and strategies to prevent a similar crisis.

Niklas Mauer: So, it's crucial to bring the decision-makers or the individuals involved in the crisis together.

E11: It's the crisis team that reconvenes, the same team that handled and managed the crisis. They are responsible for implementing preventative actions and applying the lessons learned from that particular crisis.

Niklas Mauer: I completely understand that point. It's important to have a process like this in place. In some other expert interviews, there's a recognition of its importance, but sometimes they don't take the necessary time. It's reassuring to know that this is actively implemented at Anonymous AG. Moving a step further, considering the various tools you've described, do you see potential for AI implementation, perhaps in social media monitoring or assessing the impact of a crisis? With the integration of AI into Power BI tools and the broader Microsoft 365 ecosystem, can you envision additional potentials in that direction?

E11: Yeah, absolutely. Another aspect of my role involves consumer service. I lead a team responsible for managing our global call centers and channels where consumers can voice product complaints, provide ratings, express preferences, or report adverse reactions. Monitoring these channels is a crucial part of our job. AI plays a significant role in this area because situations on social media can appear serious, but lack sufficient information. Leveraging AI intelligence helps us provide better responses and understand consumers' concerns before they escalate into crises. Utilizing AI in consumer relations for proactive actions is a key focus for us. For instance, we receive various consumer inquiries, and the board takes every complaint seriously, forwarding them to me. We aim to understand if there are unaddressed issues, why consumers couldn't find information, or if there are minor concerns

that, although seemingly insignificant, matter significantly to them. AI can help optimize responses in such scenarios. Additionally, for actual crisis management, employing an AI tool could be beneficial in the prediction phase. While we may be familiar with handling known crises based on past experiences, each crisis is unique, requiring a distinct response. Daily, we encounter different situations, and having an AI tool for scenario planning, training local crisis managers, and anticipating various crisis scenarios would be valuable. Using AI for training purposes to understand potential crisis types is beneficial, although I wouldn't rely on AI during an actual crisis response.

Niklas Mauer: Do you think in the AAA phase or during the crisis response, AI could serve as a supportive tool, providing suggestions for crisis response or task generation, particularly considering tools like chat GPT in scenarios like dealing with a crisis in China, for instance? Then, during the process, you could review and ensure everything is in order, similar to how you mentioned earlier about project management and addressing tasks more openly if AI has generated transcripts and tasks for a final check.

E11: Absolutely, that would pertain to the assess phase. AI could assist in determining the required personnel. It could suggest the team members needed, and you're right; these could be the tasks we need to perform. Since our crisis management process is relatively new, lacking technology support, your perspective is valid. AI could indeed enhance this aspect. Using it as a supportive tool in this sense would be beneficial. It could automate the identification of the necessary team members based on previous similar crises.

Niklas Mauer: That's a crucial point, tailoring the response to each unique crisis. Are there other limitations to consider regarding AI implementation, or conversely, why is human involvement still crucial in crisis management?

E11: I believe that with every crisis, there must be some empathy involved. I place a question mark on whether, for typical crises like product withdrawals, which are somewhat routine, there's still an emotional or empathetic aspect. Every crisis has a certain emotional or empathetic feel to it, whether it's internal, questioning why it happened, or external, as it affects people, and we need to take responsibility. In nine out of ten cases, we find ourselves needing to provide statements, either externally to the public or internally to employees. I feel that having AI generate a statement raises questions about whether it matches the company's sentiment, reflects the empathy we want to convey, and effectively communicates our message. So, from that perspective, I would say AI presents challenges; however, I shouldn't criticize it without giving it a try. We could encounter crises like kidnapping cases, involving families.

Niklas Mauer: Indeed, the emotional intelligence aspect is crucial, as you've highlighted.

E11: Absolutely. I believe the emotional aspect is crucial. For instance, if we consider a scenario where one of our employees is traveling to Brazil or Mexico and gets kidnapped, with their whereabouts unknown, you have the family here, and you must convey the situation to them. So, from this perspective, determining an appropriate response becomes quite challenging.

Niklas Mauer: Do you also see potential trust or liability issues arising from the use of AI?

E11: From a legal standpoint, yes. If we base our actions on legal advice provided by AI and it turns out to be incorrect, it could lead to legal complications. There are situations where we might make decisions aligned with AI recommendations, but they may not align with our

business's principles or values. This could pose a challenge in terms of legal considerations and the direction we want to steer our business.

Niklas Mauer: I totally understand. And, as time is running a bit short, I'd like to conclude with one last question. Is there anything you'd like to add or that seems relevant in the context of AI and crisis management?

E11: For crisis management, I believe AI is a great technology and incredibly helpful. Specifically, in the realm of consumer response, which is also part of my global responsibilities, AI has significant potential. However, in terms of crisis management, I would raise questions about the emotional or empathetic aspect in certain crises, not all of them. While AI could be effective in the majority of cases, it's essential to consider how to use AI in a thoughtful manner in crisis management. Even though this is a new journey for us, and we haven't fully embraced all the technology, I wouldn't rule out AI as a supporting tool in future crisis management endeavors.

Niklas Mauer: Indeed. As you mentioned, it's not only new for your organization, but in general, technology is still relatively novel in this space. It's like looking into the crystal ball and anticipating what could happen next. Many of us probably didn't anticipate the impact of generative AI, for example.

E11: You made a really good point there. If you consider the rational and emotional aspects within a crisis team, introducing AI can bring a sense of rationality and emotional detachment. For someone like me, dealing with AI is preferable because it promotes a more rational and calm approach without the panic that can arise from different human viewpoints. Having one unbiased view is quite tempting when it comes to AI. As a crisis manager, my role involves bringing calm to the situation, soothing stakeholders, and eliminating unnecessary emotion. This can be challenging from a human perspective, and that's where AI could be a valuable asset. It allows me to say, "This is the view we have, and this is the view we should go with," making the overall process a bit more straightforward.

Niklas Mauer: That's perfect. It adds another dimension to the thesis, touching on several points that will certainly enhance the discussion. As time has flown by, I truly enjoyed our conversation. Also, I'm not sure if Lily mentioned, but we would be happy, or I would be happy, to share the master's thesis or even the transcripts if it holds value for you to review.

E11: Absolutely, because, as I mentioned, AI is one of those things every company needs to grapple with. It would be great to see others' perspectives on it, their responses, and how they are incorporating it. It's all part of a learning exercise for us, especially since the world we live in changes rapidly, and every crisis is new to us as well.

Niklas Mauer: Sure, I'm happy to share for both sides—what's in that thread and my takeaways from the interviews. To add more value, you can conduct your own analysis. Just as background, we interviewed people from academic backgrounds, businesses, and even those with an outside perspective, like working for the UN, who deal with crises regularly. I hope it proves helpful for you. Enjoy your time.

E11: Thank you, Niklas. It was really lovely talking to you as well.

Niklas Mauer: Yeah, likewise. Enjoy the rest of the weekend. We'll stay in touch.

E11: Thank you, and best of luck with your master thesis. I look forward to seeing the result.

Niklas Mauer: Thanks. Bye.

Appendix 5.12: Expert 12

Transcript for the expert interview

About the master thesis *"Artificial intelligence in crisis management - an analysis of potentials and limitations to enhance top management responses as part of business resilience."*

Name: E12

Company: Anonymous

Position: Risk Management / International Banking

Email address: Anonymous

Interviewer: Julia Steyer

Date: 20.11.2023

Interview Objective:

This survey aims to facilitate dialogue among crisis management, AI experts, and Nova SBE students. In doing so, an exchange of information will take place that targets the topic of "Artificial intelligence in crisis management."

Julia Steyer: I would just say it now. Perfect. Great. So, let's start, and beforehand, it would be great if you could give me a brief overview of Euroorganization and your role in the company, just a short introduction, and also how you have touchpoints with AI or crisis management.

E12: Well, I work in risk management for an internationally operating bank in the context of Brexit. We have about 1200 employees, not members, employees. I am the Head of Operational Risk. This includes resilience topics, and the connection to the topic is that we handle very large amounts of data every day. We have very heterogeneous data. The operational risk topic covers everything from pandemics to contact issues, technology, outage, process errors, and fraud. So, in my field in the risk area, it is very diverse, large, and has a lot of heterogeneous data. We deal with indicators or data that we read, measure, and evaluate every day. I can only emphasize that, compared to Credit Risk or Market Risk, we deal with a very large and heterogeneous data landscape in Operational Risks. Great, I understand. To put it on a scale a bit, considering your company size and industry, how would you rate the readiness for technology on a scale from one, okay, basic principles somehow outlined, to ten, or the adaptability? From one to ten, one to ten. One to ten, okay. Well, we already have, so before I give the rating, maybe what we have, which banks generally have very well, is a lot of data. So, a lot of data in-depth, then very heterogeneous, as I mentioned, and also data that is really very complex. So, many data and also very deeply analyzable. Maybe for the scale, for my own employer, for the current one, I would say we might be at an eight, and what is missing for a ten is essentially contextualization. So, that's what I have in mind, even without what we discussed earlier. So, what is ultimately missing or what is the tip of the iceberg, the icing on the cake perhaps, is that one can contextualize all these data for evaluation. Yes. Not just focusing on Parameter A or Parameter B, but that the parameters learn to speak with each other. And they give a risk manager a kind of risk radar, showing, "aha, in this area, we have a problem because now in, I don't know, a location in Europe, the power outage is increasing, so we obviously have a risk there. But how can you contextualize that, maybe with other data, yes, so that you basically have better predictability. So, the data is there, the data needs to speak better with each other. Ultimately, as a human, I can't link them together. Technology must help us so that the data learns to speak with each other, so that a better risk prediction can take place. That would be my answer.

Julia Steyer: Okay, great. Yes, this is already going a bit into my second question. So when you say that this and that is simply missing to really use technological progress in a certain way, are there, if you now consider the phases a bit, you have already spoken about early detection, if you now consider these process phases a bit, such as early detection, then somehow strategic decision-making, a kind of performance control and monitoring up to, okay, organizational learning, how to learn from a crisis, what limitations or challenges do you currently see in crisis management processes or in terms of information processing, time, and cost factors?

E12: So maybe you could be a bit more specific. Because the data, because we have very heterogeneous data that are very broad, if I may say so, there is, in principle, a bit of a lack of centralization of this data, that there is a portal, a portal solution, where everything comes together, because you might get certain emails on a topic, that there is an indicator now somehow yellow or, sorry, instead of green, yellow or red, there are only single-track notification channels. So, as I said, contextualization means connecting the data with each other. You might have to park the data in common data repositories, and in terms of communication, we rely on the tools themselves, that we evaluate them, but they also have certain dashboards or we rely on email-based alerts. But that needs to be differentiated. For each tool, for each data, silo is the way to go, there is no proper harmonization. So, a lot is still done very manually, a lot of manual effort in Excel and PowerPoint to prepare this early detection. Then, of course, at the second step, because we already know certain indicators, we are also able to automate it and say, okay, these indicators, this set, this dashboard, we would like to have it every month. So, there are already institutionalized processes, but they are also relatively slow, not very agile, and not particularly punctuated regarding escalation. Senior managers also have to log into tools, start certain queries. So, in principle, what is missing is an auto cockpit, speed, gasoline, maximum speed, rpm, thermometer or temperature of the engine in that direction, this cockpit, this cockpit vision, that's what I would like, that one can make it more transparent to senior management, when you see, oh, we have a problem in this and that country, that you can go in there and then see contextualized data on this matter. So, it is partial, it needs to be consolidated into dashboards, into radar systems, risk radar systems, and machine learning, I have no exposure to that, so I don't think these systems are so advanced with us that they can do that.

Julia Steyer: Okay, well, that would have been my next question. If you can already in some form say which tools are used in your case to get a bit more specific.

E12: So, in the end, we use databases, we use browser-based dashboards, Tableau, yeah, that's a keyword, it goes beyond Excel pivot tables, a mix of Excel and Access, where you can compile your own queries. But that's all, it requires a certain level of user experience, it's not something a senior manager can do and tell the board, "Please put together an Excel yourself," so it always needs a definition, a reference point, exactly, so that the key data points, the key data parameters, are recognizable, explainable, and that, in principle, it is intuitive, so that you can drill into the data yourself, whether it's region, product, employee, however, you analyze it in depth, having such a self-service that is adjustable according to the VP's, board's, or analyst's questions, that it is calibratable in terms of evaluative capability or going to the entire board or the supervisory board, that's behavior we still lack, these are still partly manual processes, where PowerPoint is also used, of course.

Julia Steyer: Okay, I understand. Do you still see any potentials and advantages of AI implications in this context, in crisis management, also speaking broadly, generally speaking, not necessarily in your company setting, but something that you say, okay, there is definitely a need, there or that could be productive?

E12: Yes, for example, I have a very small team and very limited resources, and we still use quite a few resources just to identify the problem first before analyzing it in depth. If we can leave the identification phase to the algorithm, the machine, then we can ask specific questions about the problem, like, "What is happening here? Is it a recurring problem?" and so on. That's where humans add the most value because they can explain to the board, "Okay, it's repetitive, it's not repetitive, what is the actual problem?" It always needs a certain runway, like in ski jumping, the chance, so it's not just about jumping well, but you also have to prepare the jump well, and there we simply lack automated tools to get into this analysis, into this deep-dive phase more quickly. Yes, you know what I mean. In that aspect, technology can support us, it needs to support us much better so that we can contextualize and tell stories and focus on specific events, so that we can do that, so that we can focus on that.

Julia Steyer: Very good that you brought that up just now. Maybe in that context, when turning the tables a bit, what abilities and resources does an organization need or, from the human side, must be provided to effectively integrate AI in some form into the crisis management process?

E12: Well, firstly, there is the need for the ability to accept these tools, to understand them initially. Honestly, I am somewhat of a technology skeptic in a certain way, with everything that is being sold to us and how everything works. Ultimately, it's just connecting databases and asking clever questions. But, first of all, there needs to be an understanding of how the algorithms ultimately work, what they can do, what they cannot do, which is also very important. And then, of course, there needs to be people or processes that enable that. Just because I'm here in this organization and maybe have a rudimentary understanding doesn't mean I can apply it. So, there needs to be an enabling process through consultants, through perhaps university informants like you, your team, I don't know, to explain how contextualization does not take place in the actual analysis but in understanding. What can AI actually do and what can't it? Yes, I think that's still a black box, maybe even more than the technical hurdles of capacity because the power consumption and so on. I believe the very first hurdle is that we need to be able to adapt human behavior and say, okay, we can use AI for this process, and you need to focus on B instead of A. And we somehow need to be guided, it's not a self-runner. Clear, understandable. Resources, well, it needs those enablers, maybe also a bit of time to understand and penetrate it on our own. So, there basically needs to be an exchange so that we open up to these techniques and then understand how to actually incorporate it into daily use. I think that's very important. Understand. And skills, of course, maybe somehow. I don't think we need to code, so people who can code are in high demand in the market, but I don't think senior management is capable of that, I don't know, the middle management maybe not even me myself, but again, we need those enablers who then handle the question, like in physics class, look for, solution. How do we get to the solution, and how does this AI thing help us concretely? I think that might be the core role for the next two, three, four years. Yes, I understand. So, would you also say that a certain insight, a bit of a bringing together of requirements and leadership qualities, also from top management, that they, as you briefly mentioned earlier, also have the mindset to familiarize themselves with AI, to accept the tools in some form, to see a solution, and then to have the skills and knowledge to carry out the whole thing? Exactly. And then maybe also to show certain examples of what is perhaps an industry standard, because I think banks are very different in how they operate, that you do a benchmark analysis, where is it being used now? And then, of course, there's maybe an aspect we haven't considered yet, the whole regulatory issue. For example, we'll be audited. We can't just implement anything. We always have to be able to precisely show this, these connects, for example, for a credit decision, even if a machine does it, we always have to be able to explain how the machine makes that decision based on which parameters. That means, if I implement

something for risk management, for resilience, I always have to tell the regulator exactly how the machine's parameters work to identify, for example, a high risk in a business and a country. So, there must ultimately be transparency in how it works, and how the data is handled must be clear, where the data is stored, Cloud, non-Cloud, insecure third country, and so on. So, that must be a clear analysis parameter, how the data is ultimately protected and how the handling of the data is, and also the protection of the data. Germany is very strict compared to other countries due to this especially high standard. So, it must be clear as an analysis parameter how the data is protected and how the data is handled and also the protection of the data. That is very important because otherwise, completeness is not ensured, there may be a certain bias that management itself may not see, and then wrong decisions may be made. I think that is very important. And the evidence for the entire scene, I would say, for the entire industry, I think that is maybe one of the criteria. To create this acceptance on the user side as well as on the regulatory side. Because just demanding it doesn't help, I think it also has to work. So, it must be predictable to some extent, I would say, what is said, what it can

Julia Steyer: Okay, then maybe to briefly ask you a concluding question and also to hear your personal assessment again. How do you see the development, in terms of the future outlook and the role of AI in crisis management, and the classic question also, how do you see the whole aspect of whether AI can replace humans, especially in terms of Resilience Crisis Management and maybe the integration of AI systems, where you say okay, there is definitely potential there and it could be established and integrated in some form.

E12: Let me think for a moment. Exactly, so ultimately, how should I say, it's almost philosophical. It is, of course, desirable if we could compensate for the weaknesses of human decision-making with AI. So, in principle, if we could control everything through machines, that might be an ideal state, and it must go in that direction, advancing automation, not just manually, singularly, non-contextualized viewing and somehow analyzing data. So, it must clearly go in that direction because the data volumes we have are simply unmanageable.

Julia Steyer: So that's clear, but on the other hand, as a risk manager, I always say, also repeatedly in lectures, "Banks need to understand and have proper control over their machines." That's what I said, not just the regulatory point. Despite all this imagination, we must always understand what the machine is actually doing, and we must sometimes justify ourselves to regulators that the machine is doing what it does. When we have interview processes, when we make credit decisions and other decisions or crisis management.

E12: So be better and more confident in crisis situations. There is always a lot of hustle, a lot of emotion. It requires analytical understanding and a toolkit, and that's where AI comes in. AI must always be controlled, that's what I said earlier, it's repetitive in that sense. So, I see it to that extent. A big weak point, of course, is always the human, the human in decision-making, how they evaluate information, how they don't evaluate it, how they are overconfident in certain things, whether it's plane crashes or, I always bring up the example of Chernobyl, where really the world's best people managing those nuclear power plants, I think they also had good analysis tools and so on, but they consistently made wrong decisions from situation to situation. And they were not overruled by the machine, but they overruled the machine, and then there was the disaster. And I think, regardless of the nuclear power plant issue, this interaction, Human Being and Machine, is extremely complex and is now experiencing disruption through this AI thing. But what the target state is in this balance, whether you understand the machine or not, whether you have control over the machine or not, I think it always has to be there, but it's like a race.

Now the AI thing is coming to the streets very quickly, and humans have to look at where they stand, so what is their role, what can they do, what do they want, and where do they want to go? Almost from a philosophical point of view, I would say there is this competition going on because humans naturally still have a certain function, a certain purpose. They also don't want to replace themselves, so that's a contradiction that you notice throughout the whole interview. Of course, we can automate a lot, we can automate checks, but who controls the automation, who controls the machine? There probably still needs to be someone who simply looks at what is happening, so you need some kind of technology impact assessment that is critical for the whole topic. You see it, for example, in algorithmic trading, there also need to be strict controls so that we see, okay, even if the machine is trading, what are the volumes, how much are we trading in the market, are we always trading only up to a certain percentage in the market so that we cannot manipulate the entire market? In short, maybe I have a biased opinion as a risk manager, but we always need to know exactly, we must understand the machine and always know what it is doing. But it is not an enemy, that is also clear, I believe, you have to detach yourself, but we must understand how it can help us and where it cannot, that is somehow, I believe, very important because crisis management also includes humans. When there is a flood, what does AI help with? People have to be rescued, so there are very different parameters where you can rely on it or not, but I always think of this Chernobyl example, where basically everything was there, the measuring instruments worked, there was no measuring error, the error was basically the operation of the machine and the element of overconfidence, that people thought they were smarter and cleverer than the machine, but they weren't. Totally, so an important point that you may also need to differentiate a bit, what kind of crisis is it, such as natural disasters or a poorly functioning system in that context, and exactly, that people in some form are still fallible and also make wrong decisions.

Julia Steyer: Thank you very much, so I would stop here for now.

Appendix 5.13: Expert 13

Transcript for the expert interview

About the master thesis *"Artificial intelligence in crisis management - an analysis of potentials and limitations to enhance top management responses as part of business resilience."*

Name: E13

Company: E13

Position: Professional Crisis- Emergency- and Business Continuity Manger

Email address: Anonymous

Interviewer: Niklas Mauer

Date: 08.11.2023

Interview Objective:

This survey aims to facilitate dialogue among crisis management, AI experts, and Nova SBE students. In doing so, an exchange of information will take place that targets the topic of "Artificial intelligence in crisis management."

Niklas Mauer: Hello Daniel, thank you for your willingness. Could you start by saying a bit about your role and your background in terms of crisis management and perhaps also about the touchpoints you have already had or have with AI?

E13: So my role in crisis management or in general now, I've been here in the group for almost 3 years and my job is to oversee or manage the group-wide emergency and crisis management. Managing includes all the tasks, i.e. setting guidelines, minimum requirements and operational support in crises and emergencies. And supervision of the Group crisis team at the highest level - that's my other background before I studied security management and worked in the emergency services for 5 years. As we are highly investing in AI, I would consider the technology readiness level of the company between 7-8.

Niklas Mauer: So, let's go a bit deeper into strategic crisis management. If I remember correctly, you were also at Leiden University, weren't you?

E13: Yes, exactly, that was in The Hague. That was a stopover, so to speak, and I also spent a short time at Leiden University, but mainly it was a university of applied sciences in The Hague.

Niklas Mauer: I see. I wanted to ask briefly because Leiden University is one of the leaders in this field.

E13: Absolutely, yes.

Niklas Mauer: And how are you already using artificial intelligence in crisis management? Or how far along are you at system level in supporting crisis management with AI tools?

E13: Well, artificial intelligence is no secret in the company, and the AI park is currently being built nearby. There are many initiatives and efforts to use processors and general targets in this direction. It's a popular thing in operations in particular, but we're not there yet in our

department, at least not in my day-to-day work. It does affect me in a small way, but I can't say exactly how far we've progressed. But it does affect us in other areas.

Niklas Mauer: Understood, thank you.

E13: Yes, for example, I find chatbots an interesting tool for preparing exercises. We need to carry out training and exercises as part of the requirements, simulating different scenarios. For example, if a natural disaster scenario like a flood is needed, I can tell the AI system that I want such a scenario and it helps me to create resources and scenarios quickly instead of doing it manually.

Niklas Mauer: This mainly means training for employees in the organization. I've also seen that the organization has recently invested in AI, which indicates more activity.

05:53 E13: Absolutely, AI is a big topic in all areas, but in our department it is not yet so strongly integrated into actual crisis management, at least not in my role. I see it more as support, especially in the creation of exercises and scenarios. That's the main area where I use it. For example, I can relatively easily give instructions to the AI to generate social media posts or other posts for exercises.

Niklas Mauer: I see. Maybe we could divide the process into four phases. We have the prediction phase, where you determine when a crisis is looming. Then we have the strategic decision-making phase, in which actual decisions are made. Then managing the crisis and finally organizational learning. Have you already had contact with these training courses, as we mentioned before?

Niklas Mauer: How are you involved in the implementation? And then in the organizational learning process. We've already touched on the subject of training.

E13: Exactly, training was an issue. In terms of early detection, we haven't worked directly in this area, but we have looked into it. There is an extremely useful tool called "AVA" that records and analyzes incidents around the world. We can learn from anywhere in the world and generate relevance for our work. This is more about early detection and incident management than crisis management. In general, it is about recognizing incidents at an early stage, as we are active worldwide and have to take different events into account. A shooting incident in London may have a different relevance to one in Chicago.

E13: Yes, that's one way of filtering information. For example, in Chicago, we only receive shootings that take place in the immediate vicinity of our plant. Mhm, yes.

Niklas Mauer: Got it. How do you differentiate between incident management and crisis management?

E13: Exactly, crisis management is basically a coordination of different departments to deal with a major incident. Incident management, on the other hand, is much smaller and deals with specific, one-off situations, be it a demonstration, limited flooding or a local power outage. Here we need fewer resources and the collaboration with different departments is less extensive. Essentially, crisis management serves to coordinate decision-making in complex situations with many parties involved.

E13: In a way, the Risk Monitor is independent of this.

E13: That's right, the Risk Monitor is a kind of upstream function that monitors crisis management and also covers emergency and incident management. It is responsible for early detection and monitors which incidents occur worldwide or internally.

E13: Emergency management is about collecting and monitoring information. Crisis management comes into play when a crisis team is needed and major incidents have to be dealt with.

Niklas Mauer: Got it. Does that mean that crisis management is ultimately the task force that coordinates for any crisis, such as the use of social media or PR, where other departments are more involved?

E13: Yes, that's exactly how it's structured. The task force is only activated when it is needed and it is the crisis team or the crisis management team that coordinates the response.

Niklas Mauer: Okay, got it. One more question about the tool called "Ava". Can you spell that please?

E13: Ava, I think that's right. They were the first on the market, and then Ever Bridge and Crises Twenty Four came along. They're trying to implement similar ideas now, but I'll have to check again.

Niklas Mauer: Got it. I've heard Ever Bridge before from other experts. It's often the case that when a good idea comes up, especially in software, others try to copy it.

E13: Absolutely, those are the big players, Crises Twenty Four and Ever Bridge. They offer comprehensive incident management platforms and there is a lot of interest in simplifying incident handling for customers. We don't have that in place yet, but in other companies where hundreds of emails come in every day about different situations, filtering and checking whether a situation is relevant can be a tedious task.

Niklas Mauer: Yes, absolutely, that's an important point. Sure, they're all trying to offer some kind of all-in-one solution to strengthen their unique selling points and market position. Let's go back to the management challenges. What are the main limitations or challenges you see in crisis management where you think it might make sense to use a tool?

E13: Yes, that is of course part of the strategic decision-making process. I don't believe that the actual decision-making process is the problem, but rather the challenge lies in preparing the necessary information. Crisis management is always about having enough information available to make an informed decision.

E13: The most important thing is to gather all the available information in good time and prepare it in the best possible way. One of the biggest challenges is to filter out the relevant information from the flood of information so that the crisis team can make a decision.

E13: That's a big challenge. The most important thing is always to make a decision. In the training courses, I always emphasize that the worst thing you can do is not make a decision.

Not acting is also an active decision, based on the information available. If no information is available, that is also information you have. The biggest challenge is to create this awareness.

Niklas Mauer: Artificial intelligence could probably help to manage this flood of information more efficiently in the future.

E13: Absolutely, yes. For example, current events that do not represent a crisis for us, but nevertheless generate a lot of information, could be processed better. The processing of information that takes place throughout the day could be improved. This could also include the provision of decision-making options. I could well imagine, for example, asking an AI what to do in a water or natural disaster and it providing a list of actions based on previous examples. That would be my wishful thinking.

Niklas Mauer: I see. The actual decision making is probably still up to top management, both because of the specific issues and for legal reasons. You also have to take the team with you.

E13: Absolutely, in the end the responsibility lies with the decision maker or the head of the crisis team, who has to make the final decision. Of course, this is done in consultation with the group, but ultimately a managing director or a top manager is above everything.

E13: The managing director's name is on the paper and he is also legally responsible for it.

Niklas Mauer: Yes, I understand. I hadn't previously realized that legal liability exists in combination with this issue. So it's not possible to shift responsibility onto the algorithm or artificial intelligence alone.

E13: Exactly.

Niklas Mauer: Let's go one step further. We've discussed the issue of liability. Is there still potential in terms of crisis management and perhaps also performance media, or do you already have tools in place to improve the task force's project management?

Niklas Mauer: Are there ways to improve communication?

E13: In general, apart from AI, we have already looked at many tools for project management. There are many tools on the market that support crisis management, such as Microsoft Teams or similar platforms that facilitate the exchange of information.

E13: These tools offer functions for logging and task management. We have tested many of them, and in the end they essentially do the same thing as Teams or comparable platforms, namely information exchange, logging and task management. So this is technological support that is already available to us. One of my tasks is to ensure that the measures that have been taken are followed up and implemented.

E13: Yes, that is of course also a way of automating task management.

Niklas Mauer: That sounds good, and that reminds me of Teams, which has already improved in this respect. They are already taking some of the pressure off. Logging is the next step, where the transcript can be revised and tasks and steps can be added. The coordination of open tasks is also important.

Niklas Mauer: In such cases, a notification could automatically be sent to the responsible department without you or someone in operations having to check this manually.

E13: Yes, exactly. When you say that tasks are recorded directly from the spoken word in the meeting and converted into tasks, then that is an efficient option. The minutes could be created directly in the meeting and the tasks could be integrated.

Niklas Mauer: This would probably make back-office tasks easier, especially in terms of communication. Many people currently use generative AI tools to create reports that are then revised manually. That's very interesting. Do you see potential for future learning and support from AI and tools? Or are there any limitations that you see?

E13: If I look at it from my perspective, I would say that there are certain things that AI cannot do. For example, analyzing whether something went well or badly. An AI can extract information, but it can't understand what the processes were like, how the collaboration took place and what actions were taken or should have been taken. The sequence of events, the collaboration within and outside the teams, all of this is information that AI is unlikely to be able to process in a meaningful way. It would be difficult to assess them as AI cannot capture emotions or understand the interpersonal level.

E13: Understanding the human element that goes on in the background is one of the biggest challenges.

Niklas Mauer: Do you see any other important factors that managers and decision-makers need in such positions?

E13: That's a very good question that I've thought about a lot myself. It is very important that they create a clear structure and are able to communicate this structure. This doesn't necessarily mean that they have to take over the moderation, but they should pull the strings in the background to ensure that the crisis team can work effectively. They can delegate the facilitation, but the structure must be in place. Another key aspect is that they must be able to understand and involve the team members in the decision-making process. They must have the ability to make the decision-making process efficient and communicate clearly.

E13: The ability to bring the team constellation together in the best possible way is crucial.

Niklas Mauer: That is certainly important in order to implement decisions efficiently within the organization.

E13: Yes, assertiveness also plays a role, especially in difficult decisions where the benefits are similar and internal coordination is important.

Niklas Mauer: In terms of the fact that hard decisions or decisions with similar outcomes are often difficult to make, as AI is usually very benefit or function-oriented.

E13: Yes, that's true. Sometimes AI lacks an understanding of emotional issues or long-term thinking. For example, it can't take into account whether we might want to take a different production direction in 10 years' time. AI has its limits. It also often lacks assertiveness. An AI will never be able to say: "You, you have to do something now."

E13: Yes, that's right.

Niklas Mauer: If we talk about the human factor that was mentioned before, the overall sentiment within the organization is seen as very positive, apart from individuals. From your point of view, what issues have been relevant so far in convincing top management to introduce such tools to relieve their workload and support decision-making?

Niklas Mauer: Or artificial intelligence?

E13: Yes, the most important thing, as you've already mentioned, is relief. It is crucial that these tools are always a relief and not a burden. We need to make sure that these tools make decision-making more efficient, especially for top management. Artificial intelligence should help to simplify tasks that humans alone cannot do as efficiently, such as information processing.

Niklas Mauer: This also means that it's important to give employees the time and space to get to grips with these tools.

E13: Yes, that's crucial. You really have to get to grips with the tools and there has to be a clear benefit for the organization. If the tools don't deliver the desired results, then they don't serve their purpose.

Niklas Mauer: At the end of the day, there has to be a business case behind it that justifies the introduction.

E13: Exactly.

Niklas Mauer: Interestingly, how is the work perceived within the group? You often hear that certain departments, such as Organizational Development, are often seen more as a cost block than as real help.

E13: In our case, the perception was very positive. The topic of crisis management has become much more important, particularly as a result of our recent experiences with corona and other challenges. The costs compared to the benefits are quite low, especially when we conduct exercises involving top managers or high-ranking members of the crisis team. These exercises are very efficient and provide a good opportunity to demonstrate the value of crisis management work.

E13: So the work is appreciated and we get enough resources to fulfill our tasks. This is especially the case compared to the more expensive resource of senior management that participates in the exercises.

E13: Yes, exactly. We've seen that risk and crisis management is very costly.

Niklas Mauer: Yes, it makes sense that the investment is worth it, especially if it helps to prepare the organization for crisis situations.

E13: Absolutely. We can't always measure the financial benefits directly, but creating a more efficient structure and decision making is invaluable.

Niklas Mauer: Got it. And what do you think about the role of AI development? It's developing so quickly, but do you see great potential for it, especially in the area of case management?

E13: I don't think AI development will be as strong in crisis management for the time being. Teams and other areas could probably benefit more from advances in case management. For crisis management, the focus is more on decision-making and governance. Nevertheless, aspects such as situation assessment and external information could benefit from AI tools in the future, especially in international crisis situations.

E13: But in terms of AI, there is definitely great potential for growth in many areas.

E13: But you also have to consider whether we are mainly working with statistics or AI. For me, AI always has a self-learning component. For a long time, we only used statistical analyses, which have been used in various areas for a long time. For example, we analyzed sales figures to determine on which days in summer more water is sold. All of this was based on statistics. But it's important to keep an eye on the self-learning component in order to exploit the full potential.

E13: Exactly, that also applies to texts and emails. The software can already predict the next step based on the information it receives. For example, it could highlight specific events based on your preferences or a selected region. This is much more than just statistical analysis.

E13: Absolutely. If someone creates meeting transcripts, that's not AI in itself. But when the software automatically recognizes what needs to be done from the transcript and identifies recurring patterns, then we have a self-learning component.

E13: Exactly, the idea is that the software learns and improves based on recurring patterns and tasks in the transcripts.

Niklas Mauer: Right, it's not just based on keywords; it can derive actions from the entire text. Sounds very promising and has already been immensely helpful.

E13: I think it's great to talk about this topic. It offers many possibilities in various fields. As for crisis management, I haven't fully considered it yet, so I think it's good that we're having this discussion.

E13: It's interesting that data plays an increasingly important role in the security industry. Often, there's a lack of sufficient data to gain meaningful insights in the security field.

Niklas Mauer: Yes, especially with theft, there are issues with data quality and training data for AI. One approach could be to aggregate data from different companies to make better deductions.

Niklas Mauer: Yes, that could definitely be a solution to obtain high-quality training data.

Niklas Mauer: Maybe we can share the overview of the interviews later to present anonymized statements and categories, so you can use them in your work.

E13: That sounds good. I'm definitely interested. What's the timeline like? When will you be finished with your work?

Niklas Mauer: The deadline is in 5 weeks. The interviews should be completed by the middle of next week, and the initial overview could be ready in about 2 weeks. We can then schedule a brief coordination meeting if there are any questions.

E13: Sounds good, I look forward to the results. Do you already have enough experts for the interviews?

Niklas Mauer: Yes, we already have experts from various fields like academia, research, consulting, and industry. That should provide a broad perspective.

Niklas Mauer: I researched the topic from various sources myself. Crisis management became particularly interesting during an internship at a consulting firm when I dealt with semiconductor supply chains and their impact on the automotive industry. It's also fascinating how current events and crises affect the work of security departments.

Niklas Mauer: Yes, it's definitely a niche topic, but it's highly relevant.

Niklas Mauer: Yes, it's a complex world where various disciplines interact with each other.

Niklas Mauer: Exactly, it's difficult to find the right experts for the interface since many disciplines are involved.

E13: Yes, there are many disciplines dealing with similar topics, such as risk management, corporate security, and crisis management. They often have their own focus areas and different approaches.

E13: Exactly, often crisis management ends up in the security field because there's no clear responsibility.

E13: Yes, it's an exciting and challenging job. I enjoy working in this field.

Niklas Mauer: That sounds like a fulfilling role. Thank you for the conversation, and we'll certainly meet again. I'll get in touch as soon as there's something to report.

E13: You're welcome, I look forward to it. Ciao!

Niklas Mauer: Thanks. Bye.

Appendix 5.14: Expert 14

Transcript for the expert interview

About the master thesis "*Artificial intelligence in crisis management - an analysis of potentials and limitations to enhance top management responses as part of business resilience.*"

Name E14

Company: Anonymous

Position: Senior Manager - Cyber and Strategic Risk

Email address: Anonymous

Interviewer Jessica Kunac

Date Oct. ,

Jessica Kunac: So that it's transcribed correctly, as it's very convenient. In my bachelor's, I didn't use it; I recorded everything and then transcribed it, not even saving.

E14: I know that too well; I had the same experience with my master's thesis. It was really a struggle.

Jessica Kunac: So, spending days transcribing these interviews without much interest, and I apologize for that. I might have to blow my nose occasionally because I'm a bit under the weather.

E14: No problem, take your time, don't stress.

Jessica Kunac: Great, so maybe, in general, let's start with the master's thesis. I sent the questionnaire; it's okay if you haven't looked at it yet. The questions are good to answer even without prior knowledge. Our master thesis title is "Artificial Intelligence in Crisis Management - an analysis of potentials and limitations to enhance top management responses as part of business resilience." It might sound overwhelming, but it's about the influence of AI on crisis management and how it contributes to building business resilience. I don't know about your experiences, and it's about the connection of these components. Initially, could you briefly mention your role and organization? You don't have to mention me in the interview, just the role. You can skip some details about the organization to divide where there are intersections with Artificial Intelligence or crisis management—both if possible, so I can explain.

E14: Sure. I'm a Cyber Resilience Response Manager in the Business Line Risk, focusing on the Cyber area. We deal with various teams and structures in the Cyber area, addressing Cyber Resilience. This includes preparation, reactions, and aftermath of Cyber Incidents or crises. My focus is on resilience, mainly in preparation, planning, and organizational and technical setup. We cover traditional areas like Business Continuity Management, IT Service Continuity Management, Disaster Recovery, as well as Emergency and Crisis Management. We touch on diverse topics, and it's an ongoing story with different perspectives and interfaces, including party risks, information security, and softer factors like cultural change. Currently, our emphasis is on Emergency and Crisis Management, Business Continuity, Service Continuity, and building a broader resilience framework.

Jessica Kunac: Thank you; that sounds promising. I'm responsible for preparation and early detection in this master's thesis. It sounds like preparation is a significant aspect, and it's

exciting. Now, of course, I'm interested in how the company positions itself. Considering your work environment, company size, industry, and so on, how do you perceive the readiness for technology? Do you think you're at an advanced level in terms of the technology readiness level, which can vary widely? How do you assess adaptability to technologies?

E14: Hmm, maybe a fundamental question before I delve into that: should I speak from the perspective of the company I currently work for or from the viewpoint of the client projects we undertake in consulting?

Jessica Kunac: Also, include experiences from other companies, like partners you've worked with, or clients, without mentioning names, of course. Feel free to incorporate anything you think is relevant.

E14: Sure.

Jessica Kunac: We don't limit it, we just structured the questionnaire that way, thinking most responses would refer to internal situations, but feel free to cover everything.

E14: Yeah, I'd keep it broad then, mixing in what we have internally, not explicitly highlighting it, maybe anonymizing a bit and ensuring I understood correctly. Your question was about technology readiness, especially how it looks in the current corporate landscape?

Jessica Kunac: Exactly, just how willing people are to adopt technologies and the state of readiness, considering there are areas where people might be enthusiastic, but the technologies aren't quite there, addressing both aspects.

E14: Got it.

Jessica Kunac: If you can send it in the chat, that would be great.

E14: Otherwise, I'll dive into it. It's a profound question for me, so let me see if I can give you a good initial response. Hmm. I see, I've opened the questionnaire again, the Technology Readiness Level.

Jessica Kunac: Yes, it's there in the survey. Today, I noted down what the parameters are, so if you tell me, I can fit it in at the end. But if you say, "Hey, we're at a certain level," that works too. Let's take a moment to go through it.

E14: Sure, that's a good question, but not an easy one.

Jessica Kunac: True.

E14: I'll start. Feel free to interject; my thoughts might wander a bit, but I need to organize my thoughts as I talk. The point is, I think fundamentally, every company sees technology as a boon initially because what do they expect? Usually, they hope for efficiency, maybe for easier tasks, especially repetitive ones—tasks that can be repeated easily, are easy to apply, and probably prone to fewer errors. So, efficiency and cost savings, that's, I believe, fundamentally what all companies find appealing. Then it goes into how well it actually works.

E14: In my opinion, this has several components because, on one hand, you need the capability to implement technological changes, which can be a massive change. Especially in well-established companies that have grown significantly, possibly over old IT infrastructures, dealing with a lot of legacy issues. It might not be easy to make that technological switch. It involves considerable investments and change for the organization. In contrast, smaller startups or those still in the scaling phase might have different foundations and find it easier to get started. So, this change component is a crucial aspect on the technological side. On the other hand, it's also about taking the users along because it doesn't make sense if no one can use it in the end. The topic involves considerations like how companies can effectively utilize things like AI assistants, considering legal and data privacy issues. So, beyond the technological challenges, there's the additional layer of making sure it makes sense and bringing the necessary competencies to the people.

Jessica Kunac: Right.

E14: Correct. So, how do you ensure efficiency and effectiveness in the end, that's what matters. So, it's about what brings value, and that involves both technological components and competencies. I think there are certain sectors, industries, or branches that might be more inclined or advanced in this area. When I reflect on it, there are probably sectors where use cases work better. I can imagine that in the case of the service sector, especially in banking and insurance, many things can work well, and they might have a significant interest. Parenthesis open: I spend a lot of time in the financial services sector with clients, so my insights are likely deeper there. On the other hand, they also have higher complexity, I think, in implementing some of these changes. Whereas, if you think about startups or newly founded companies, regardless of the industry, they might have an easier time adapting to new technologies because they carry fewer burdens of legacy systems. So, looking at the scoring, it's quite broad. The question is also about the Technology Readiness Level, which can range from low to high. Seeing the context, I'd say, I could imagine a solid medium to medium-high scoring in the financial services sector. In traditional sectors like production, it might still be a bit lower, considering the shift towards IT. It's challenging to assess at the moment. From the consulting industry perspective, I think they might score a bit higher because they need to stay abreast of the times and see how they can leverage these technologies for research or data processing. But it's a rough estimation, and it's not that easy. Another component is on the EU level with EUEIA, and there's quite a bit happening there. If I remember correctly, it's even on a global scale. Yes, now the word "pioneering" comes to mind, and there's probably nothing comparable globally. It's a significant initiative in the EU, trying to address various risks. Feel free to provide feedback if this aligns with what you're looking for because the more I think about it, we could probably spend an hour philosophizing on this. But I'd appreciate your feedback.

Jessica Kunac: No, maybe not. I am heading in the right direction. It might be a challenging question to start with. We intended to get exactly what you mentioned. You've clustered it a bit in the consulting aspect. How is it in other areas?

Jessica Kunac: Then you haven't focused on services, so that's meant to go beyond that. We hope to get a response to this question similar to the one you provided. In the end, we might say, "Hey, it's different in startups than in large corporations, and the industry might be more advanced in certain aspects." So, it was a great answer. I would write something like medium to high, just as you suggested, without specifying a precise number, but stating it as it should be.

E14: Okay, gladly.

Jessica Kunac: Thank you, and I believe we'll revisit these questions in the interviews.

E14: Of course.

Jessica Kunac: The questions will go into more detail, feel free to elaborate on all industries that come to your mind.

E14: Gladly, maybe one concluding sentence that comes to mind: I think it has a lot to do with knowing these variables and working with them. For example, how technologically adept are your employees? How well can they handle it? What skill set and willingness to change do they have? If we look at these variables, we can probably go through industries, sizes, or types of companies, from startups to well-established ones. That would probably give us a good overview.

Jessica Kunac: Absolutely, and that's precisely what would greatly help us, even if it's not the core topic. It's an essential factor that shouldn't be left out of consideration. Thank you very much. Now, those were the introductory questions. Let's go a bit deeper. As I mentioned earlier, we are a group of four people, and we have divided the master thesis into areas. We write the general part together, but we have specific areas. There's the early detection and integration, as I mentioned, then the strategic decision-making where decisions are actually made. What implications can help in that area? As the third topic, we move on to the area of when the decision has been made, and it needs to be reversed. How can AI support there, and what is the process? We've named it "Firmenmanagement in Control." Finally, organizational learning—what insights can be gained, and how can it be integrated into the organization in the long term? Just as a background, that's what I've given. In the next questions, it would be great if something comes to your mind for a specific area, regardless of which one. Just drop it in when answering, or I'll guide you back to it if needed. It doesn't have to be for every question in all areas. Sometimes you might not have it in mind, and that's fine. Let's start with the first question: What limitations or challenges do you anticipate in crisis management processes, particularly concerning information processing?

E14: That, and trying to fit it into the phase, so perhaps something very generic comes first. The fundamental challenge in crisis management is decision-making under time pressure. On one hand, decision-making under uncertainty, meaning one is forced to make decisions even if the situation changes shortly afterward—the parameters change, the circumstances change, but one has to make decisions, especially under time pressure. Most often, there's a time constraint in decision-making, and you might not be entirely clear about all factors. Minutes later, you might know more, and you would have decided differently. So, decision-making under time pressure and uncertainty is a significant challenge. That, of course, leads to the topic of information handling and time delay. Under time pressure, it's crucial that information comes in quickly, and handling information is a major theme. How do you get updates, especially from all relevant areas? What are the relevant areas? How do you ensure that you have this overview of information, and how can decision-makers process this information? How is it visualized in an operational sense? How is it tracked? How is it continued? All these points play a significant role. Now, when you think about the early detection preparation phase, I would say it's more about creating conditions in that case—training people to act without fully understanding when the real situation comes. How much do these preparations, testing, and training actually help in

real-life situations? How is the setup done—clear roles, responsibilities, visualization of information, and so on? When preparing for crises, especially in our crisis management process overall, clarity is essential. Certainly, if we talk about early detection, there are likely various types of information streams, reporting channels, and so on. How do you even get information in the first place? How is the escalation triggered, perhaps a bit too close to the crisis? How would you retrospectively retrieve information if, for example, an action taken initially doesn't yield any results or if there are issues that may not be severe but still need to be integrated back into information processing? Understanding the triggering event and its causes at the beginning is crucial. I think, especially in the strategic marketing phase, during these periods of performance management control, all the things I mentioned earlier come into play—working under pressure, time constraints, uncertainty. When it comes to cost factors, I'm not entirely sure what contracts mean, but making the wrong decision can undoubtedly incur costs. On the other hand, there's also the question of what one should prepare for in crisis management—does everything need to be over the top, or is a simpler and perhaps more sensible approach better before people get confused? I believe these are genuinely the points in these phases.

Jessica Kunac: How is it in that case?

E14: For critical decision-making, performance management control, and also in the area of organizational learning, I think, just going over all the topics and information, the cost factors you mentioned in English, even though you read it in German. So, I hope the transcription doesn't go haywire now because you switched to German.

Jessica Kunac: It's taken worst-case; that means I can write it all down again.

E14: Very good, very good. As I said, with organizational learning, it's a classic. People like to take credit for continuous improvement and subsequent debriefing, but do they actually do it? Because it involves effort, costs time, and there are factors such as people being tied up. Do you even start again with the information you've gathered or decisions you've made? Do you really go into detail afterward and evaluate the whole thing? Do you go through step by step? What are the formats? It's all very time-consuming and intensive, and then you also act on what you've recognized, and in practice, it often turns out well. Usually, you manage to get through, regardless of how much you've invested. Then people might ask, "Why should I continue investing, or why should I bother if it somehow worked out? We got through it." I think especially in this phase, that also plays a significant role if you've managed to get through so far.

E14: We might have had a resource-intensive time, and now investing a lot of time and money retrospectively might not be the most appealing. I don't want to say that the willingness isn't there, but maybe the last part of the answer is more suitable for later. On the Unity, they often use these terms, and that was actually for organizational learning and change after such an event—perhaps more of a chance, I think, to seize the momentum and see how to turn the right screws with a sensible use of resources.

E14: I think those are the points I'd bring in for this phase.

Jessica Kunac: Yes, I'm really excited because you've actually integrated it perfectly into the phases. We didn't expect it to work so well, but I'm naturally all the more pleased. So, if I say that, I'm thrilled.

E14: Yes, thank you, because it was my personal challenge, and I felt triggered.

Jessica Kunac: Very good, then we did it right, didn't we? That's a lot at once, so we didn't expect it in this form, but I'm very, very positively surprised and, of course, happy because it will help me a lot in the end. I can directly categorize it. So, for the next questions, feel free to do the same if it fits and works, and if not, that's okay too. Exactly, with the next question, we're moving a bit away from... Of course, it's always about crisis management, but it's more focused on IT tools. It's not just about AI tools but also other technologies. Please mention everything in that area that you or in your experience have used to prevent, manage, and learn from various types of crises—again, following these phases.

E14: Mhm, okay, gladly. In my opinion, that can be easily categorized into the phases again, or okay, it acts on all phases. Let's start with the action preparation. Here, particularly what I've used, what we advise clients on or where we provide support, involves all topics related to alerting/notification tools. That means how do you sensibly get your alerts from relevant stakeholders? Especially in the last crisis management team or other teams that need to be informed—employees need to be informed accordingly. So, there are various tool providers on the market where you can choose all channels, from emails to push notifications or even calls and faxes in some cases. You can select all possible channels where you trigger the alert or simply send notifications. In the Early Detection area, there is, of course, a whole range of things. Let's open the information faucet on one side. There are providers that address both physical security and cybersecurity, reporting threats, vulnerabilities, specific risks, and so on. In the cybersecurity area, monitoring plays a significant role. You use Security Operations Centers or Security Information and Event Management (SIEM) tools, where, based on use cases in your team environment, you perform anomaly detection. You look for instances where data is suddenly moved at odd times. Files are being accessed strangely, and if there are indicators of compromise or something similar. In this area, there are also ideas for, or the other way around, Management Action in Response, where, based on use cases and triggers, activities are performed. For example, accounts might be blocked, or network segments might be isolated. You can, of course, drive this even further with AI, perhaps with smarter use cases, considering more variables. I think a lot is happening in this area, but I don't know many that use it yet. I believe it's happening more with the theme of evaluating all this information, and probably more filtering it out as positives rather than negatives. It's probably more about sorting out information from all these qualities and other surrounding issues. In my opinion, this is much about the detection preparation phase. Another thing we also do for people and other companies is trend monitoring and trend radar. This is more towards strategic foresight, where you are on the go. These are less points where the classic alarm pops up in the next hour, but rather, it's about preparing for crises, probably more from a long-term perspective. There are trend monitoring tools and radar tools that evaluate sources based on AI, derive trends, and much more. This is another level of crisis management.

Jessica Kunac: Super, I'm really grateful.

E14: In summary, I would say because it's a completely different strategic direction, perhaps quite interesting, I don't know if you're familiar with it. We also have Future Foresight at our company, kind of like Future Foresight Quarterly. It's a small detour, but maybe quite interesting for you. I remember it happened around 9/11, the USA. It was relatively unsurprising, I believe, for the Coast Guard. I'm not sure right now, but luckily, somehow at the end of the '90s.

E14: I believe somehow that's why they had at some point really played through certain scenarios for Reading For Site, and there was also a scenario in it. In it, what happened unfortunately, had a dual Trade Center character or at least similar effects, and I think the US Coast Guard was cool with that. It had forced politics, was surprisingly well-prepared for such an event due to certain political foresight preparations. It's a whole different story because you're more into this organizational adaptability, flexibility, and mindset. I don't know how you might consider that later because there are so many resilience and crisis management topics, operationally, tactically, and strategically. Probably, one could even do doctoral theses on them in English.

Jessica Kunac: Yes, you mentioned two, as we cover both. We want to keep both open first and then see which direction we lean more towards. One is the expected, something that is not even expected.

E14: Mhm, yes. However.

Jessica Kunac: Something that somehow arises unexpectedly and perhaps not even expected, something that needs to be driven but suddenly occurs and changes the entire company structure, affecting all areas, not just focusing on one aspect. And then, crises that may actually be related to a specific industry or cause harm to a particular company, like the VW scandal.

E14: Yes.

Jessica Kunac: That's more like a company-specific scandal, exactly.

E14: I understand. Yes, I have to be careful not to drift too far off with the questions, so let's stick to that. We were still on the topic of tools; that was about decision-making performance. I think it fits well, as I mentioned before, also involving decision-making and controllers; I'm combining them even if it's a bit broad. Decision-making is derived from information management, so that's the point: how do you sensibly sort all your information? You might have a monitoring dashboard or various tools that provide some output. Does it work? Is it fed sensibly, is it processed properly? There are tools in the market where you can input information in a kind of ticketing system, where you can build situational pictures, and classic ones. I believe technology will help a lot in sorting out the massive information during a crisis because crises usually bring both information scarcity and information overload. The question is how you separate the important from the less important for your decision-making. I can imagine that conducting scenario simulations will help. To have a good information basis, there are technologies that allow you to create virtual situational pictures, and that's where you need to manage information properly. Technically, it could facilitate things a lot. In the area of Performance Management Control, I think it's a bit less spectacular because it's mostly about task assignment, who does what when, and then seeing how the execution goes. It's probably more about how new information is enriched. I think various ticketing solutions, sometimes interconnected with alerting solutions, cover this quite well. I can't think of much at the moment because it's more about the classical task tracking and how new information is enriched. If we now think about learning from organizational learning, you have points like how you extract information from the entire story flow, how you evaluate it sensibly, and that could facilitate not having to go through pages of situational pictures for a week. You can probably analyze it in a more measured way. You can look at the basis of decisions made, tasks completed, what has been done or how much has been done, and combining these different data sets could make it more technical and efficient. At the moment, I think that, in this phase of Organizational

Learning, a lot is being evaluated. You can even look at technical logs if the crisis was caused by technical issues. Across the phases, these are the points that come to my mind. Maybe, in conclusion, it will be interesting in the combination from architects' planning to tracking and decision-making. Starting with tracking and then evaluating, if you manage to break things down and stack them, where does it start?

Jessica Kunac: Which information was available? Why were certain decisions made? And then steering the further tasks that came from that.

E14: Based on the information, was it reasonable? Probably making it easier rather than having someone manually do it all, especially with the flood of information during a crisis. In conclusion, I think it will be interesting to combine the architect's perspective, starting with tracking, and then evaluating. Once you've managed to somehow dissect and overlay things, where does it start?

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E14: Well, I think I would rather take the direction where I would have liked to have something because, based on my experience, there is still relatively little applied technically in that area, maybe more isolated, as I mentioned. Not much has been applied, at least from what I know or what has been done so far, and I haven't seen much A applied in crisis management. I believe it's interesting; for example, I take the Covid example. I was part of a crisis team for a client because I supported them externally. There were discussions about how to handle remote work, what we need to do, and the big questions that not only concerned the company but everyone, such as how far the progress is— not the personal health progression, but the timeline or curve. Should we act? Why the development? Will it be over quickly? Will it be permanent? Will it last longer? So, correlating with current developments worldwide, and people were always looking at what was happening globally because ultimately, what happened somewhere else seemed to affect us a few weeks or months later. I think it would have been interesting if there had been something like that.

Maybe it's interesting to mention that it doesn't have to be company-specific; these questions interested everyone. Both on the government side and the company side, everyone seemed to be thinking about it, and I think that's a point that could be quite interesting. Otherwise, what could be interesting is maybe in the context of—I'm just thinking of another example, not physical but digital—like a digital virus. I was involved in a situation where a client was actively attacked by ransomware hackers. It could be interesting to see what can be done manually with open-source intelligence. Specifically, looking at whether there are any indications of attack patterns on a hacker group through open-source intelligence, like how do they usually proceed, is there any crisis decryption, and so on. I can imagine that maybe it could be quite interesting to manually comb through darknet and other sources, which you usually do with open-source intelligence, to see if there are any attacks to correlate or if others have dealt with similar patterns or similar exploitation of vulnerabilities to get out of such a situation. So, I could still imagine crisis management being at the forefront in these areas where a lot is corrected through the combination of open-source intelligence and pattern recognition.

Jessica Kunac: Very nice, thank you very much. It's great that we touched on these perspectives. I can definitely take away a lot from this. In this context, I would like to ask about the benefits because we've talked quite extensively about it. You've already mentioned what advantages it

has, which we didn't assume, but all the better. So, let's jump right into it, and now it's about what skills and resources companies or organizations need to successfully manage crises, to master them, and also to integrate them sensibly. What things need to exist from the company's side?

E14: Well, I've already touched on this a bit initially, saying that everything is easy. I sometimes tend to get ahead a bit.

Jessica Kunac: I think it's good; it brings a lot to me.

E14: So initially, what I mean is that this topic, you can utilize people, and I often see this from an IT perspective, especially when you use tools like alerting tools or ticketing tools, or any tools available. It really depends on the know-how and acceptance. You can introduce all the fancy tools, but if nobody uses them because they find it inconvenient or they don't know how it works, it's useless. So, that's really the foundation, and it's always challenging because it takes a lot of time and resources, without any guaranteed immediate results. These are the classic issues in crisis management, and in the past, people would question why they should spend money on something they hope never happens, and it never did. Luckily, that mindset has changed.

I believe it's crucial to convey the skills, to take people along, to make them understand how to use the tools, why they are using them, what benefits they bring, and also what they may not be able to do. Sometimes, there's a tendency to think a tool is fantastic, throw it onto the problem, and not have to worry about it anymore. However, that doesn't work in crisis management or other situations. The key point is how crisis management is integrated, and that's really crucial.

Jessica Kunac: Yes.

E14: So, why do you want to use it? Just saying it's great for crisis management won't work. You need to start with specific use cases and test them excessively or in real cases. What value do I expect? Why do I want to use it? I think a phased approach makes sense, figuring out in which phases to apply it and correcting it. It's about getting people involved in those phases and utilizing the resources so that there is acceptance. That's really the point. Critical resources, as you mentioned, are crucial because you need to see it through. Especially in the current phase where there's a boost, you probably need to deal with a few setbacks or cases where investing time and resources doesn't yield immediate results. You'll need to experiment, and it's important to stay committed. Having a certain error culture and being willing to push through even if you don't have the final super-use case overnight is crucial for success. I think that's another point that could be meaningful.

Jessica Kunac: Exactly.

E14: I haven't really focused on the phases, but I think across phases, it's quite generic. I don't know if it's specific to any phase. I believe that the topic of use cases is crucial in every phase. It becomes even more critical; I would say decision-making is crucial. Depending on what you want to achieve with your crisis management, you need to rely on it because decision-making is under time pressure and uncertainty. You need to be able to trust what comes out of it. I can think of simple examples like Bing Chat Enterprise or something similar where they've slipped in things that simply weren't true. Maybe the technology wasn't up to par, or there was a case where a lawyer cited a case that turned out to be false. It's crucial that decisions made in a crisis

are accurate and existent. So, in this phase, decision-making is probably even more critical, and it's important to differentiate.

Jessica Kunac: Well, super, a great point. Maybe let's revisit that later. I'll wait a moment. It fits well. Exactly, perhaps for the next question, I think you've already answered a significant part. How can organizations prepare, especially from the top management level? Do you believe that something needs to happen there? What do you think is important for the successful integration of AI? Do you think top management plays a significant role, or do you think it's evenly distributed across all hierarchical levels?

E14: Hmm, it depends, as they say. It really depends on the corporate culture, regardless of how flat the hierarchies are, there's always some management. People still orient themselves around that. So, it makes sense that support is there, actively promoted, and someone feels responsible for it. Classic, but the understanding is crucial, especially for top management. Dealing with an information flood from various topics simultaneously, everyone saying it's super important, makes technology competence increasingly important on the agenda to be able to participate and decide. I think that's an additional crucial point for top management.

Jessica Kunac: Super, thank you very much. Now, moving on to the last question from the main blog, it's about data protection concerns, a significant topic when thinking about AI and technologies in general. I believe you have a lot to share on this. Have you encountered situations where there were significant data privacy concerns, especially regarding crisis management? If not, also in a general sense, and what potential solutions do you see, or how have you dealt with these issues in those situations?

E14: Well, not much in the context of crisis management because, as I mentioned, it's not as prominent in my opinion. Most concerns are in other domains currently. I think the concerns are similar to the classic ones: where are the data processed, what is revealed, what types of data, similar to using GT or cloud solutions. I believe it's quite similar from an initial perspective.

Jessica Kunac: Yes.

E14: Of course, I could imagine that for hackers, it might be more interesting to target such solutions or providers, especially if there's a significant amount of data being processed. There may be more to gain, making it more appealing from an attacker's perspective. But I'm thinking if there are new data privacy concerns specifically, as it seems like a standard topic. Because there's a lot of data processing, ideally already secured. I might overlook something, though.

Jessica Kunac: That's a good point. So, if you don't feel that it's changing significantly in other areas, then that's also valuable information.

E14: I would say the answer is too easy, to be honest. I can't think of anything concrete at the moment. Probably, I'll look into it later, that's my initial gut feeling. I'll research it again later.

Jessica Kunac: Sure, if you come across anything later, feel free to let me know. You don't have to do it if it's not convenient, only if you're already doing it. Now, moving on to the concluding part, a bit about how you envision AI changing in crisis management in the foreseeable future. Do you think it will become more relevant, given that you mentioned it's not the most utilized

area currently? So, looking at the next few years and maybe beyond, do you think it will become relevant, or do you believe it will remain a challenging area?

E14: No, I believe it will definitely become relevant. I think the investment trend from the major players is moving closer, and many companies are considering it. It's just a matter of when it will become more prominent in the context of crisis management or be more strongly focused on. There might be different worlds, with providers already involved in emergency, crisis management, and communication examining or integrating solutions. The question is whether the market is currently putting the emphasis on it. I could imagine that initially, from a very business-driven perspective, there might be an attempt to optimize business processes before delving into crisis management. It's unlikely that the focus will immediately shift to crisis management in this area. However, I do think it will become relevant because AI will impact every aspect of our lives to some extent. It will come, and I no longer believe the horizon will be 10 years.

E14: I'm not committing to a specific number, but I can imagine that it will be relevant much sooner, maybe significantly within the next few years. Providers are likely already delving deeper, attempting to integrate it into companies at the moment.

Jessica Kunac: Perhaps, in that context, looking at the other side, as you mentioned earlier, especially in this decision-making phase, it's essential to trust the data gathered during the preparation phase. To what extent do you think AI can replace humans in crisis management, both in the short term and the long term? Because it's always a topic, as you mentioned in the introduction, where decisions need to be made quickly under pressure, and it's either relying on AI or having humans involved. Can you speak a bit about the limitations you see and the role of humans?

E14: Yes, a few insights to wrap up?

Jessica Kunac: Absolutely, that's great.

E14: No, the big question is how well it will develop. I mean, of course, everyone would find it fantastic if there was minimal human involvement in the end. Probably, it can be further reduced; however, these solutions need to reach a certain status first. The status needs to be determined. I do believe that, and then it starts again. What falls under the category of crisis management? Some are very operational or tactical tasks.

Jessica Kunac: Yes.

E14: I can partially imagine that these might involve less human intervention sooner, especially since I come from the server space. If you look at the whole incident management, action response, or whatever, I'm not sure if you're familiar with it; I recommend looking into it briefly. There's already a lot of conditional, if A then B, use case-based actions. In these technical areas, I can imagine that human involvement might decrease relatively quickly. I can currently envision that from a strategic perspective, or truly strategic crisis management, whatever that may entail in detail—there could be examples, but it's what one envisions as strategic crisis management—might still be relatively distant compared to operational activities, smaller tasks, and multitasking. So, I think there might be a difference there.

Jessica Kunac: Thank you very much; I see that we've reached our time limit.

Jessica Kunac: I'm sorry that I kept you for so long, but we're almost done. The last question is whether you have any additional information, procedures, or anything that came to your mind during the interview that you would like to share. If not, we can wrap it up on my end.

E14: Exactly. No problem because I've covered a lot of ground. One point that actually came to my mind was, perhaps I missed it in one of the questions or maybe it wasn't directly in your focus, but I thought about the risks for companies within crisis management. Specifically, the component of crisis communication in crisis management. I consider crisis communication as a part of crisis management to be crucial because it allows you to manage a lot of information for crisis management and also steer and coordinate the involved parties. However, I'm contemplating whether it can be used counterproductively.

Jessica Kunac: Yes.

E14: When we think about things like social media storms and Shitstorms, where companies respond, you can use AI to potentially target companies deliberately in such a Shitstorm and bombard them. I'm considering whether you can reverse this, perhaps with AI, and initiate protective campaigns against companies where you flood them with massive content and nonsense on Twitter, other networks, generating fake images, fake videos, and so on. It doesn't have to be just written content, and you can create a massive crisis communication issue for companies. I'm just considering this perspective when you turn it around.

Jessica Kunac: That's a really good point, especially with the risks. That's something missing a bit from the questionnaire; it's different from the limitations. I think we wanted to cover a bit of the ethical and human aspect, but that's a good point, and it's something to consider for the next interviews, which I hadn't thought of.

E14: Exactly, I think it's interesting because you can see what false information can trigger in forums worldwide, and you can massively influence people's behaviors. You can influence stock prices; you can influence the behavior of humanity massively. If you can't manage that, competence also comes into play, people recognizing and countering such fakes in general. I believe a lot of mischief can be done in that regard.

Jessica Kunac: Well, it's definitely a good point, and it will certainly be considered because, of course, we don't want to sugarcoat everything. I believe there are significant limitations that we currently face, and therefore, it's a valid argument to say, "Hey, somewhere, this is not beneficial for the company, especially for crisis management."

E14: Exactly.

Jessica Kunac: It can even trigger crises itself, very much so, but I will definitely include that. Great, if you think about it in the coming days and any other thoughts come up that you feel might be interesting for our work, I would greatly appreciate it if you could write to me again or get in touch. Otherwise, thank you very much for the excellent interview. I'm incredibly pleased that you went into the questions in such detail because I remember from my Bachelor's that sometimes the answers were very brief. You provided really interesting perspectives, so I'm looking forward to incorporating them into the work. I also wanted to offer again that I can send you the final work if you're interested, and then you can also see the contributions from

the other interviewees. We've had around 15 interviews, and maybe there's a bit of information that comes back to you, so you have that exchange of information.

E14: Sure, I'd be happy to. I appreciate the offer, and I'm curious to see the results, what findings you have. Good.

Jessica Kunac: Very nice. Well, thank you very much again. I'll replace the placeholder name with the correct one in the confidentiality agreement. I apologize once again for that.

Appendix 5.15: Expert 15

Transcript for the expert interview

About the master thesis *"Artificial intelligence in crisis management - an analysis of potentials and limitations to enhance top management responses as part of business resilience."*

Name: E15

Company: Anonymous

Position: Civil Protection OrgL and ÖEL, BRC Head of Operations, EU Civil Protection Mechanism Lead; Project Lead Crisis Management with AI Technologies

Email address: Anonymous

Interviewer: Niklas Mauer

Date: 09.11.2023

Interview Objective:

This survey aims to facilitate dialogue among crisis management, AI experts, and Nova SBE students. In doing so, an exchange of information will take place that targets the topic of "Artificial intelligence in crisis management."

Niklas Mauer: Hello, Mr. Kippnich, I hope you're coming back well from your lunch break and could take a short break?

E15: Yes, during the break, I never really get a break, I would say. By three-quarters or 50, we need to be finished. I generally need to stay motivated, actually. At least, my colleague has brought me some water, which is good, as otherwise, we could do this every morning. It's clear.

Niklas Mauer: Sure, I believe, I believe I understand. I'm also grateful; I'm quite good with the bender, so maybe that's a plus. But I would suggest we keep it brief so that you can get back soon. Exactly, regarding the master's thesis, I've already sent you the interview guideline. The goal is to explore the crisis management process in both organizations and companies to identify whether artificial intelligence could enhance it or if there are implications preventing its use. It would be great if you could share insights from your area to identify potential opportunities or barriers. We would also be happy to share the other expert interviews or the master's thesis with you afterward if you wish. Just let us know.

E15: Yes, we can do that; we'll make that happen.

Niklas Mauer: Perfect. In a first step, it would be helpful for us to get some context. Although the interviews will be anonymized, if we could get an indication of the size of the organization and the level of technological readiness within the organization.

E15: Okay, that alone will take hours. I've sent out the declaration, signed it, and that should be standard. I also sent it to the municipalities. We are one of 19 states that use it. I don't know if you are in a rescue organization?

Niklas Mauer: Yes, exactly. I'm also part of the SEG, involved in the rapid response group and with the water rescue based in Wülfershausen.

E15: Yes, regarding our organization, we are a billion-dollar company, one of the 19 regional branches of the German Red Cross. We are the only ones called Bavarian Cross because we are a public law corporation. We have the largest non-governmental ambulance service in Europe with over 7,000 employees, 400 ambulance stations, and 27,000 full-time employees in various fields. That's the brief overview.

Niklas Mauer: Yes, that definitely helps for orientation. I assume that in terms of technology and capabilities, you're quite advanced, especially for coordinating between different units and the ambulance service.

E15: It could always be better. The question is, are you showing this or the interview? Okay, we have it in various areas. In the ambulance service, we have digital documentation for admissions to the trauma room. When the ambulance arrives, it improves patient care. Then, of course, in healthcare and the social sector, and we also have a large IT department. The challenge is, of course, with so many different interests, to find the right common ground.

Niklas Mauer: Understandable. Is the use of artificial intelligence planned or already in use, especially in the IT department?

E15: Well, you need to know, we've been using artificial intelligence for 20 years. That doesn't mean everything is automated. It's always individual processes where artificial intelligence comes into play.

Niklas Mauer: Okay, maybe in detail, the question: for us, we've cut the crisis management process, saying we have, in a first step, early detection and preparation for a crisis. Then, as the next crucial point, the strategic decision-making, where you really decide, are we going left or right. Then, this response phase, you know, response, and a bit of performance control, and afterwards, the organizational learning. Do you have a similar structure? If so, could you maybe mention tools used in each phase?

E15: Well, it's challenging because we have so many tools. Ultimately, you'd need to talk to an expert who can say, "We have this and that in the background." I can report that we have an Amica project where, ultimately, we use drones for assessing traffic accidents. Based on deformation and various factors, that's a point, I'd say. Also, in the Eifer research report—I don't know if you've looked at it or been on our site—it might be helpful if you check our site.

Niklas Mauer: I briefly looked into it, yes.

E15: On the TV page, I mean. There, all the projects are described.

Niklas Mauer: Do I need to delve into the details again?

E15: I've written it in the chat. For example, there's an Eifer film that precisely describes the AI in a research project to enhance situational images. Yes, there's a 110-minute film on YouTube, a German-Austrian project, which summarizes it effectively.

Niklas Mauer: Perfect. I'll look into it in detail later. There's likely a lot of information to extract.

E15: It's written there, on the website, and on YouTube, the film precisely states what I want. It's always about introducing new technology or using AI to improve existing systems and processes. Then, the use of AI in graphics, it makes sense and enables new methods to optimize civil protection. I believe the crucial point is involving the users, meaning the people who should operate it, ensuring user acceptance. The fusion of various data sources, from drones, images in social media to satellite data, allows a faster overview of the entire damage area. We've tested all of this in a preliminary project at Eifer.

E15: It was also used during the refugee crisis, which was really helpful, but you can't say it's a panacea.

Niklas Mauer: Also, already really engaged, as you mentioned, and also revisited in terms of usage. There's a certain level of acceptance when you say it has been used before and is still in use.

E15: Exactly, and, I would say, under research conditions, it's a long way because until we have a unified, let's say, understanding, that's always a challenge. We enrich the people from the water rescue, and yes.

Niklas Mauer: Yes, I fully understand. Going from there, when you say there's a lot in the area of information gathering and recognition, do you also use tools to bring about the decision, or would you say that in the crisis management team, intuition and experience play a significant role in drawing conclusions? Or conversely, are there tools that suggest decisions, and then a selection is made from these?

E15: Well, I would say that it follows the standard procedure 100 for major operations, and all operations are structured and have a command process. That means planning, command, and control. To be able to set up the decision-making process on solid ground, the situation is evaluated with AI. So, we focus on worker A and not on something else, and it processes it in that way. But, you just threw everything at me now.

E15: Due to the outcome, it's not a clear-cut solution. There are so many uncertainties, and we look, okay, what is there now?

Niklas Mauer: Exactly, we've also seen that recently, that each individual situation needs to be considered very specifically. Every crisis has its peculiarities, making it challenging to get training data for artificial intelligence in advance to train and potentially provide recommendations.

E15: Exactly, that's the point. In our project, the Rescue Nation project, we recently flew for three hours in a police helicopter to generate data. It serves as a basis for Cologne. Because people say, "AI, the problem is access to data to train the systems effectively, that's the challenge in Cologne."

Niklas Mauer: Yes, how much money exactly? So far, that has been one of the major limitations mentioned by other experts, especially in these rare situations that occur much less frequently than the standard ones. It's even more challenging to access the data.

E15: Yes, and I don't want to give any away, do you?

Niklas Mauer: Exactly. Otherwise, what critical skills or abilities would you describe as particularly relevant within crisis management?

E15: Could you repeat the question?

Niklas Mauer: Yes, of course. So, what would you say are the top 5 skills that you need to bring when you are in the crisis management team? Whether it's communication skills, leading the team, etc., to master these situations.

E15: One needs, before intervening, extensive training and good education. But you also need experience from small operations over a certain period.

Niklas Mauer: Yes.

E15: You need teamwork, of course, and you must have had your share of expertise.

Niklas Mauer: How does this come about? Does it mean one spends a certain time in the crisis management team or with one's team?

E15: Exactly, through exercises nationally and, if possible, internationally, to understand more.

Niklas Mauer: Yes, understood.

E15: That's exactly what one says, okay, that's what you need now.

Niklas Mauer: Okay, so, in conclusion, would that mean that there are already many soft factors or a lot of experience, and that could have certain implications for AI since it's difficult, especially to represent that interpersonal level?

E15: Well, it's not a no, but one must definitely understand that AI can support sensibly, that's for sure. And then, you have to see where it goes and how it turns out. Yes, that means one simply has to understand everything, where it's heading, and one has to deal with AI. It's not like nobody is working on it, and we can do everything. It's essential to understand that process innovation is better than product innovation.

E15: It's useless if I have 7 accesses, but I don't know how much equipment is connected to which focus. And when I need you, I find it very nice, yes, those are such topics.

Niklas Mauer: So, could you especially see advantages in operational support where you say, a lot of coordination or even these protocols led by artificial intelligence might already derive tasks, in turn, relieving your own or actual work, allowing you to focus more.

E15: Yes, it is, so I would say, it's more of a blessing than a curse. It definitely helps, but it needs to be focused, that's for sure. It must be in a way that the application of the system doesn't block the standard processes.

Niklas Mauer: Yes, understood. May I ask, then, about the transition to the standard processes? Do you have continuous metrics tracking, or do you have different metrics for various crisis situations that are repeatedly reviewed and analyzed?

E15: We have various metrics through different channels now, disasters and rescue and protection, and the emergency medical service has metrics as well, ultimately saying, do you have something? How many operations, how many emergency calls does the control center receive? Each department has to evaluate these for themselves. For example, the Schweinfurt control center shows figures on Facebook, saying, "We had this many operations, this many before, what do you think?" We also have metrics because the crisis team is, of course, rarely in action, not frequent.

E15: And what is rare is not so well established because it's rare, and then you have to see how to manage it.

Niklas Mauer: Exactly, my question was somewhat aimed at that. How is the decision retrospectively reviewed in the crisis team or tracked, saying, "Okay, do I need to adjust my decision that I made at hour x?" Or is it more based on experience, intuition, or within the team, saying, "Okay, we're currently heading in the wrong direction; we need to steer corrective measures"?

E15: Well, then you must first be capable of receiving feedback, I would say, and evaluation is crucial. But you don't have time to do that because crisis teams are usually staffed by volunteers and in a crisis, which doesn't happen often, rare and frequent. And if you perhaps set up a major crisis team every three years, then people have to go back to their normal jobs, and that's where it often fails.

Niklas Mauer: So it often falls by the wayside because you then say you no longer have the people to conduct a reasonable, let's say, debriefing and to say, "Okay, what went well?" So, detailed feedback sessions.

E15: Take a short break; at the end, you have such a class. We meet with the people, and everyday life takes over after the operation, and it's hard to get people to sit down again.

Niklas Mauer: Okay, so introducing long-term organizational learning there might be a bit challenging, I would say, to say, "Okay, let's benefit from details or insights we gained to approach it differently in the future."

E15: Yes, really, the Football European Championship in 2024, we had the last configuration in 2015, yes, because 2005, excuse me, and it hasn't fully taken the life situation from 20 years ago into account.

Niklas Mauer: Yeah, I understand that during this time, a lot has changed, but you could then, apart from AI, also include data, quality, and relevance in this area.

E15: It's all wishful thinking, and you have to see what is realistic and what's off the table. The working behavior of all participants is different, availability, and qualification. We have incredibly high expertise in volunteer work, which is great through civilian professional work and more.

Niklas Mauer: Yes. And exactly in that area, many training sessions are offered, right? So, you can regularly have exercises for scenario X, at least to be able to provide feedback for individuals in volunteer work.

E15: Yes, it should be better together, but it varies from super good to much room for improvement.

Niklas Mauer: Yeah, understood. Exactly, getting through the questionnaire well. Perhaps another aspect regarding data protection: Do you see any particularly critical points due to artificial intelligence? That is, having much more data that could also be analyzed and possibly come to companies, or is it more under the general data protection laws?

E15: Well, that's great; in terms of data protection, it's a good question. For this, you need to know that, for example, the Eifer has an ethical board and has proactively commissioned data protection assessments from the University of Kassel to say, "Okay, we demand a lot from the street. What must be visible in the images, or how should they not be handled?"

Niklas Mauer: Yes, so that is indeed a core part of the work, breaking it down to specific use cases, then developing an appropriate data protection concept.

E15: Exactly, the data protection concept must be presented beforehand; you have to address it proactively. There's nothing worse than having everything ready, and then it falls apart because it wasn't as great as expected. You need to be clear about how it works.

Niklas Mauer: And were there any other aspects discussed in this ethical board besides data protection, which are also critical?

E15: I didn't quite understand that; could you please repeat?

Niklas Mauer: You mentioned that you had sat down with this ethical board and, along with the University of Kassel, discussed topics beyond data protection. I must say, with new technology, we are increasingly in the spotlight.

E15: Yes, exactly, everything related to the Ethical Board. Does it have an impact? Well, I don't have it memorized, but it influences the decision-making processes. How is the user? Quote analysis, yes, how is it ethically? Whom do we reach with the photos? For example, is it compliant with data protection, or is it not? If it's data protection compliant, there's also a Can, for example, yes because, I mean, if I want to use Skype, for instance, there might be data protection issues. Data protection is essential, but it's not professional; you have to see what fits, and if we approach it cleanly and proactively, there is much higher user acceptance.

Niklas Mauer: Okay, understood. And generally, regarding user acceptance? What is it currently like? Because, on the one hand, we notice a lot of hype that has partly subsided, but I assume...

E15: Yes, nobody knows what is and what isn't, that must be said. Most people don't know. But the user acceptance is high because people don't even know that it's AI we're using.

Niklas Mauer: Because you can clearly demonstrate the added value that the tool, whatever technology is behind it, provides.

E15: Exactly.

Niklas Mauer: Okay, very good. So, that has already been very helpful. Now, maybe take a little peek into the crystal ball. Do you see potential or do you find it likely that the role of artificial intelligence will further increase in the decision-making process or crisis management?

E15: I'd say it won't just increase, but it will integrate as a fixed component.

Niklas Mauer: Okay, so that's what you're saying.

E15: Also, 20 years ago, no one would have thought we'd have laptops at the only location, right?

Niklas Mauer: Yes, that's true. Just on the other hand, the points you probably mentioned earlier, such as the ethical and interpersonal aspects, will continue to be challenging to replace.

E15: Yes, because you have to be open-minded. The problem is there's an immense amount of ignorance across all layers of the population, regardless of their interest in the topic. That's the big challenge. And as a result, user acceptance will undoubtedly increase when it's implemented in other areas, for example, in supermarkets.

E15: No idea, because with AI, I have to go shopping or it's in the advertising, or, yes, that's what makes a difference, I believe.

Niklas Mauer: Yes, exactly. So, in that area, we're trying to use the master's thesis to show some potentials or maybe just give people who should read the work a bit more feeling. What's behind it? What are the potentials? Also, considering the risks and creating a bit more awareness. Perhaps to conclude?

E15: That's why we might need to actively introduce it to people. We have to take away their fear and address critical issues openly; that's how it works.

Niklas Mauer: Exactly, so everyone can form their own open opinion.

E15: Yes.

Niklas Mauer: Maybe to wrap up, a final question. Are there any topics from your side that you'd still like to mention, saying it would be important in this context?

E15: Well, it's about participating in research projects nationally and internationally to gain insights into what's being done. I'm also part of Public Safety Communication for Europe, and we've always talked about machine learning there.

Niklas Mauer: Yes, we are moving in that direction. In that sense, we also included the Institute for Strategic Risk Management and Resilience. We had discussions, and it became clear that the exchange between experts is a crucial aspect.

E15: The best thing to do is to allocate funding and time for it. Interview partners, finding them, I don't know who that is, but one must understand that it costs an eighth of a workday. If I do that four times a month, then, well, you haven't done much work in weeks. You need to be transparent and make it more understandable for the user. That's crucial.

Niklas Mauer: Yes, I fully agree with you. Perhaps one last point, do you have any brief feedback for me on the interview? Anything that could be improved in the future?

E15: Well, what might help is if you make two PowerPoint slides with a specific use case. Start with a specific use case because the topic is so broad. We can talk about AI in house alarms, in Essen, in radios, in administration, in electronic health records, in care facilities – it's all in emergency services. Focusing on that would be helpful.

Niklas Mauer: Okay, we'll take that into account for future interviews. It shouldn't be a problem to create slides quickly and present a brief case study with three key points. Perfect, that would have been from my side. Thank you very much for your time. I hope you enjoyed it.

E15: So, that's it. I hope it was beneficial. I'm always very realistic and practical with answers. They should not only sound good but be reality. And I recommend the film I mentioned; it's only 9 minutes long. All the experts discuss it, and it provides a good summary. There might even be English subtitles soon.

Niklas Mauer: Okay, I'll check it out. I'll also delve deeper into the other link.

E15: That's perfect. Just let me know. Good luck. I did it only for that, you know, to work with the younger generation. It's logical.

Niklas Mauer: Thank you, and I also need to say thank you to Sebastian Bender for setting this up.

E15: Yes, he was the one, the door opening guy. Otherwise, I wouldn't have done it. We generally reject such requests.

Niklas Mauer: I understand. Thanks again, and have a great day.

E15: Thank you. If there's anything, just let me know. All the best. Goodbye.

Niklas Mauer: Yes, thank you. Goodbye.

Appendix 5.16: Expert 16

Transcript for the expert interview

About the master thesis "*Artificial intelligence in crisis management - an analysis of potentials and limitations to enhance top management responses as part of business resilience.*"

Name: E16

Company: Anonymous

Position: Disaster Risk & Crisis Management Specialist

Email address: Anonymous

Interviewer: Niklas Mauer

Date: 06.11.2023

Interview Objective:

This survey aims to facilitate dialogue among crisis management, AI experts, and Nova SBE students. In doing so, an exchange of information will take place that targets the topic of "Artificial intelligence in crisis management."

E16: OK, one of my issues having gone through the questions is that I'm happy to talk about crisis management. However, I would have zero experience in crisis management and artificial intelligence. So, I know that's obviously what you're working towards now. I am interested in it, and I can point you to another research article and magazine that has just recently appeared. Still, I don't know how beneficial I will be regarding AI, particularly in crisis management.

00:35 Niklas Mauer: Yeah, no worries at all. It would be fantastic if you could forward the research article, but in general, yeah, we have kind of seen similar issues. So on the one hand you have like the experts in crisis management and on the other hand, you have like more detect guys or more, the guys focusing on AI and at the moment what we've seen so far is that there is like not a true link and this is kind of also the reason that we came up with the research topic to try to link it together.

01:06 Niklas Mauer: And yeah, we thought about talking to you and to other experts. They have like more crisis management related background to kind of see what tools you use, how you do your work and then like push this to some experts from AI and ask them as well. OK. Could you see some potential for this? And this tool or for this use case could you see like some benefits where AI could benefit and then maybe play it back? Uh, yeah. They're like a glad to hear that you are interested in this also about other experts told us they are like really keen on into the topic. They haven't had much time now to investigate the topic by themselves, and therefore, yeah, we're happy to share our results with all our experts afterwards.

E16: OK, OK. Yep. OK, great stuff. So, you lead and let's get started. And please feel free to start.

Niklas Mauer: Yes, sure. I would try to stick a little to the questionnaire to yeah, just make it better to compare. So, could you tell me something about like your touch points you have with crisis management within your organization and talk a little bit about the organization that you work in?

E16: So, I work for the World Food program and within the World Food Program we have an emergency. Division and within that division there is a specific department for crisis management. So, crisis management exists at multiple levels, one being strategic and the executive and corporate level of the organization. And then the other element, maybe we call that the operational element, we're exist in country offices and regional offices. I've been involved in crisis management, emergency response, disaster management for over 20 years. My and I shall background as a farm rescue service commander before I started working internationally in the Anonymous. I've also been involved in crisis management in the private sector, working with different sectors in business and industry, and adhering at times to the ISO standard, which was recently updated in 2022.

E16: If I recall, it's ISO 22361. Uh, my own opinion is that that standard does not cover everything within crisis management, and certainly not. I've went in and out of various research various key case studies, various standards around the globe in crisis management, and just really brought everything together to develop my own portfolio of training exercises, crisis management planning. And that is always specifically adopted for the industry and the particular company, organization team or department over.

Niklas Mauer: So, when you talk about that you. The bug for the World Food program what are like the crisis is you face. And what is kind of the technology level you're uses it more like still a lot of emailing or like some background technology already involved for communication for working efficiently?

E16: Yeah, sure. I'll talk about 2/2 ends of the continuum, really. At one end, there will be organizations with various crisis management systems and structures and standard operating procedures. Now, it's definitely something that is neglected somewhat in all of the organizations that that I've been working in. I mean, there might be a crisis management plan, but there's no training and exercise plant. Uh, the crisis communication strategy is maybe looked at once or twice, if even not per year. It's still a somewhat of our A reactive approach to crisis management as opposed to being proactive, having pre planning in place and embedding a crisis management culture within the organization.

E16: Now, granted that culture of crisis management might not be applicable to certain roles or functions, but definitely it I've key levels of the organization crisis management should be through the four and very and considered quite a lot in every aspect of organizational planning, from budgets right through to training, exercising, conducting drills and linking in with other departments.

E16: So, it needs to be a slightly contradictory that allow. It might not be a multiple levels and multiple functions. It needs to be an all organization approach so that particularly at the executive level, crisis managers are fully aware of what's going on at the operational level. I found it. Most organizations use existing technology. They will use, you know, communications platforms that are already in place, such as Microsoft Teams, and I've seen WhatsApp being used. I've seen. The standard emails and logging systems and networks, you know. So, it's all, uh, there's very few organizations that will employ fully embedded crisis management third parties. Um, I know they do exist for third parties.

E16: Come in and more or less manage all of the crisis management and they will bring in their own platforms and software and management that I wouldn't be overly familiar with because

everything I have been involved with has been reliant on the existing intra organizational structures on systems.

Niklas Mauer: So, so, so maybe one more question to clarify your role or to see if I got it right. So you're kind of doing some consultancy for larger organizations, smaller organization or government organization within the countries to kind of move them for more reactive to a more proactive crisis management.

E16: Correct, yes.

Niklas Mauer: OK, perfect. And what kind of limitations are like the most challenging that you anticipate during the crisis management process or talking about the detection phase, the decision-making performance and management control, communication, and organizational learning, they said like mostly related to time.

Niklas Mauer: Is it a cost factor or what else do you see those harms like the implementation of the good crisis management system?

E16: Yeah, sure. A good question. I would put it down to two main categories. One would be the human impact and then the second would be the non-human which would be system structures and equipment that are in place for crisis management. If we look at the first one, initially you rightly said there are time is always a major factor that crisis management would be weighed down the list of priorities until it's required in the response phase. So, a lot of the work that I that I am trying to do is to push prevention. So that starts off with a hazard and threat assessment for the organization, some of which might come on very quickly and might be very acute.

E16: However, if we start an in bed at preventative culture then that reaps huge benefits and it's the right thing to do because it's it can be identifying hazards or threats that are so obvious to somebody external in crisis management training. But the company has been completely blind to those hazards and threats, so moving on from prevention then we identify the hazards and then measure the risk. So, a strategic or operational risk assessment is created and again we move on to preparedness or mitigation and then response and recovery.

E16: But getting organizations on the human side to buy into this crisis management cycle or phases of planning and preparing. Yeah, it's a combination of time management and budgetary management that organizations aren't willing to do it. One of the main issues I found is that organizations they will appoint somebody for crisis management, but that person already has a primary role and function. So, crisis management is just a bolt on or an addendum to their existing role. And that's a major issue because it's just taking a box really, it's not making enough effort in crisis management.

E16: And as the old saying goes, it's all fine until it goes wrong, and then they're always looking and at everything is reactive and. Problematic so.

Niklas Mauer: Yeah, maybe couple questions. Building up on this, I tried to structure the little and could you guide me like through the process a little more like from kind of your outside perspective? Like what do you do for the preparedness? Like, do you use some scenario planning or what kind of tools are affected there? And then like for the decision making, are the tools implemented as well or like the different analysis made? Or is it like just build on the

scenario planning that you have a human during the decision and as well as they are like some control? Or how do you decide to communicate if you have the crisis in place, then how is the lessons learned going to look like?

E16: Sure. So. The process for me would be starting off with education and awareness raising and raising awareness about crisis management in general. First, is very important, but then raising awareness and educating staff members and the organization on their organizational hazards and threats and their and their risk, really, so everything comes down to risk in an organization. And this is part of a wider organizational resilience or enterprise risk management strategy that encompasses business continuity, emergency response, emergency planning. So, regarding a, that's the first stage, but then within preparedness really and then developing the crisis management plans is a tool for again raising awareness, highlighting risk on educating and developing people in crisis management.

E16: So, at the result of course you have a plan in the event of response, but the process of it because it's not ideal. If somebody like me or you come into an organization, identifies hazards, measures risk, and then writes a plan and walks away, you need to develop people within the organization so that when the consultant externally walks away, then there is a crisis management level of capability there that the company or organization can carry on.

E16: So, developing that crisis management plan is extremely important. And then training and exercising that plan in part and in whole.

E16: So, the last thing we want to do is really put people off crisis management by making it very complex training and exercise program. However, the exercise should mirror as much as possible the threats and hazards that have all been identified previously within the risk assessment of of the company.

E16: So again, you're trying to make everything fit together that people can resonate with the hazards and threats that they have in their organization, and we should use those within the exercise. And then, of course, when the exercise is completed, that everybody goes through a debriefing and after actions review process and that's all facilitated by, you know tools and diagnostics. But the reliance on the research I'm looking at the minute on the non-technical skills, you're at one end of crisis management with AI and I'm looking at the human factors and I mean I'm going to be slightly biased of course, but the human factors are just immense because you're constantly dealing with people on a one to one or dealing with teams or dealing with groups.

E16: So that social responsibility that AI might displace? I don't know enough about it to say that could be a good thing, may be a bad thing. Who's to know?

Niklas Mauer: OK. Maybe to dive a little deeper here. Uh, how does the crisis management plan look like? Is it like you have like different plans for different kind of crisis or is it more like a broader framework and building even further up on this? Is the like some implementations where you can see a iPod dentals or you started to mention maybe some disadvantage as we don't know with the human factor. Umm do more advantages and disadvantages come to your mind.

Niklas Mauer: For example, for the diagnostic parts, do you could you see like a potential for scenario planning? This AI as monitoring all kind of factors. Or would you say like as a crisis is more like an uncertain event, unpredictable that it's hard to implement AI there.

E16: Yeah. So, with uh, I'm just thinking that if a I could do certain functions of crisis management that humans can't and can do it in a way that is obviously time saving, quality assured on specific obviously to the organization and threats and hazards.

E16: I mean, it's just like so many I I've used quite a lot of diagnostics in emergency and disaster management over the years. Umm, but they don't come out really. With uh predictions or generate results that will artificially work, so everything is data evidence statistics, you know? So, it's not like you can put in certain amount of information and then there will be an AI process to give you your result. Everything is. It's very safe. It's still very, very controlled. So again, I'm speaking from somebody with a very with no experience of AI whatsoever, but it, it is something that really interests me both and crisis and disaster management and emergency response. So, I mean the try and get back on to your question.

E16: Again, Niklas, could you just remind me of what other points you wanted covered there, please?

Niklas Mauer: Yes, sure thing. I have so maybe for the AI, just in general, do you have like a general framework and for the crisis management for the plan or is it more like suited to different kind of crises? And if we go even though step. Yeah, maybe let's do this as the first part and then I don't ask for another question.

E16: OK. So, regarding the plan there, there is a general standard template if you want of headings and categories that should be in a plan. But going back to that crisis management cycle of prevention, preparedness and mitigation, response and recovery, there's another new phase coming in there, which is mainly in the international disaster management and feel our cycle which is called anticipatory action and early warning.

E16: But I am lot of that is all transferable to the crisis management sector, regardless of if it's private business and industry or UN organizations. So, the plan for me is and I use the plan as an information guide as well. I section it off and I give a lot of background information at the start because like I said earlier, I don't want to go into an organization or a department or a team and then walk away and they don't have any resources or there's no legacy of education there, on developing crisis management. So, I leave them with a plan that contains a lot of background information linked and associated with global standards, previous case studies, and that will educate people on crisis management.

E16: So, then we more or less work through the phases about being if we can prevent the crisis from happening in the 1st place, that's always a win and then moving on to mitigation preparedness response and recovery response obviously has always been the focus predominantly in crisis management and now organizations are becoming more aware of the prevention and preparedness phases.

E16: So, the plan will contain all those phases and then will be broken down. The response phase will most likely generate the most amount of information and that will incorporate everything from various structures. The role of personnel and little aid memoirs, or what we call task cards, which will be bullet points of what your role is during crisis management and

what you must do. And one of the essential pieces within the response fee is of the crisis management plan is crisis communications.

E16: So, what to do? What to say? What to say it? Who says it all that information regarding communications during a crisis and that would be contained within the response phase? Uh. Also, within the plan I would build in training and exercise a strategy or an annual training and exercise plan, and then of course operational debriefing, learning feedback and after actions, review. All of those will be incorporated into the plan.

Niklas Mauer: OK. Yes, thank you a lot for the valuable insights and maybe building up on the kind of each section in a little bit. So, what I understand from your side like you have like different tools to prepare the decision but to do like the actual decision there is like a task force or a group of people that come together and then they meet come up with the tasks and then they split up doing the work and come together to see or to execute like their crisis management plan.

Niklas Mauer: And so, you kind of have the human factor there, is it right?

E16: Yeah. OK, that's a very important point because the decision-making process is an area of work and research and very high importance, of course in both emergency response and crisis management.

E16: And there are different decision-making models around the globe. The UK Fire services have a decision-making model that that I can send on to you and it's completely reliant on the human factors and it's usually when you have somebody in charge of an incident, they're called an incident manager and sometimes in the emergency services called an incident commander, but generally that role in crisis management will be a crisis manager or an incident manager.

E16: It just depends on the organization. Now again, in this work comes back to the human factors and we're AI might be able to displace the bad aspects of the human factors, because if you have an autocratic crisis manager who just makes decisions without consulting the team without consulting reports, engaging with experts, then that's problematic.

E16: However, if you have an AI process that does all of that for you and works, then that takes ambiguity out of it. It takes personal and subjective opinion. OK, which is sometimes important, of course, in crisis management. OK, because people maybe have experience. So there's a lot to think about there and not decision making model and that's in I incorporate that into the plan about decision making and how important it is to base it on in a crisis. You don't have evidence and data to go on like we would as researchers, so you go on an aspect which is very important, called situation awareness.

E16: So, situation awareness is very multi sectoral, but usually in a in the military, in the emergency services and airline pilots and surgeons and doctors in the operating theatre and situation, awareness is just about having that full awareness of the environment around you before you make decisions.

E16: There are more technical elements to it, but that's just as a summary as we're on the chat.

E16: So, if you had AI that could conduct situation awareness, then not might be hugely beneficial as well.

Niklas Mauer: OK, so maybe one further question for that before we jump back, would you say that bias isn't issue within the decision make making fast face there, AI could help to reduce bias?

E16: EI don't know enough about AI, but if you had something that could eliminate, reduce, or mitigate bias on uh overall subjective opinion or you know autocratic decision making, then that would be beneficial at some times when there's so much discussion during a crisis, it needs an executive decision to be made.

E16: You know those some people will need to just stand up and say this is my decision. This is the rationale for my decision. This is what we're going to do sometimes that that that's required. So, you need to have something in place if you're going to replace that. That can do both. That can make unbiased decisions, but also consider other factors such as previous experience or. That's human impact, you know. And that links into the crisis communications as well as well as the decision making.

Niklas Mauer: So, so, so and so. So, so kind of asking the other way around what you're trying to say or what you're saying is that liability is an important factor to consider.

E16: Shoes. Shoes. Yep.

Niklas Mauer: And yeah, yes. May maybe traveling me a little back to the process again and would you say that it would be really beneficial if you have like a tool or like some support to do like the crisis response especially the communication so they are and tool could send you a different people due to their roles and different tasks automatically and also come up with statements as I guess all of us have worked with chat CPT lately to generate text this in some way.

Niklas Mauer: Could you see like some potential for the crisis communication or crisis statements there as well?

E16: Very much so. Uh. Maybe not on the on the final prod product of uh, Chachi, BT or AI similar platform. It would need to be check that the final stage before it goes to public dissemination. However, in a recent exercise, for example, um monitoring social media, logging all decisions, and managing logistics making phone calls, you know there's a huge amount of internal crisis communications work that that's ongoing during a major event.

E16: So, if you could take away a lot of that work, then that would be hugely beneficial because during a major incident, personnel and resources, personnel and get utilized very, very quickly. You can never have enough personnel, so if you can have a structure in place that will reduce the reliance on that amount of personnel, that would be hugely beneficial.

Niklas Mauer: So, stating it, it would be a beneficial like to have like AI doing kind of the back-office work or the operating operational work. But then you have like the human for to give for like the final. OK, checking text this for example and focusing more on the strategic side and on the important decisions and OK, great.

Niklas Mauer: And then is there like some kind of performance measurement in place as well for the crisis? So, are the KPI's or performance tracking if the responses are correct and played back to adjust them or is it like currently not a big part in crisis management yet?

E16: Yeah. No. At hasn't reached anywhere I've been involved in. There are there haven't been any KPI's or performance standards that I've come along with. However, that's not to say they don't exist in some of the safety critical uh global, multibillion dollar organizations such as oil and gas petroleum. They may have crisis management performance metrics. I wouldn't be aware of them in particular what on any of the organizations I've worked with everything comes back really to which I think is good. And the after actions review and the lessons learned, you know what went well. And I always try and get people to start. That with the individual reflection and then it goes to the team reflection, maybe the department and then the organization.

E16: And again, there's, it's not so much about performance standards and quality assurance and KPI, but in a way it may be covers all of those as well if you review them and act upon them. So that's the biggest thing we can have all these discussions and after actions, reviews and lessons learned. But you need to follow up with them with a pointing action, people to carry out the actions on a timeline of when those actions will be achieved. I'm not. Does not happen in a lot of organizations back to the original point we discussed about, which was again time and budget and crisis management not being people's primary role.

Niklas Mauer: Yes. And you have maybe involve one last question throughout up these four steps, is there like some tools in place for the organizational learning and lessons learned part and could you see some potential or like for AI or what would help you to be your better and or like the organizations to improve their organizational learning process to learn from mistakes or yeah good decisions they made during their crisis management process?

E16: Yeah, definitely. Again, alongside, yeah, I mean there are the actions that after actions review the AAR lessons learned and sometimes then there are investigations also which will look at the after-action review and lessons learned are not there to attribute blame. They're there for the organization to improve. However, an investigation again, it's not necessarily designed to blame, but because of an investigation, there will be culpable people who will be responsible for certain decisions or a lack of decisions. It just depends however, if you have A and when I do an after-action review in lessons learned depending on the audience or the organization you work with, it might all be digital based.

E16: Using a combination of anything from Google forms right through to the Microsoft Office forms is I think it's just called forms. I can't remember off hand. I also use Kobo humanitarian toolbox. Again, it just depends on the audience. The digital literacy is just not there at this stage, and it wouldn't have been relevant to the audience, you know.

E16: So yeah, I think there's a role there for AI will then all that data and information management within an after-action review. Again, it's going to need a combination of decision makers to decide on. OK. And the human factors, what do we do next to? How is this going to work? What do we need to do? We need more budget. Do we need more time? Do we need the appoint a crisis management department? So again, all of those within the process, you know, coming out of this. And again, I don't have enough about AI, but I think there's huge potential for AI and. It's just where and how.

Niklas Mauer: Department. Maybe adjust came or and trying to come up with a potential use case and would it help if you have like a tool and collecting the information and kind of collecting information about the decisions that are made and trying to conduct it, condense the information and helping you like to analyze the process to come up with some good implementations or recommendations for organizational learning.

Niklas Mauer: So, kind of doing a review by and tool saying OK, you made this doesn't this decision. Here you have the outcomes and so it's preparing or it's giving you a recap of what has been made in the short way, and then you could build up on that.

E16: Yes, absolutely. Absolutely. I think if, like we probably with all of those, because there is so much stake at stake in crisis management, I mean it could be financial, it could be reputation, it could be engaging and disseminating a huge amount of information to the public. Let's take COVID-19 and the pandemic as a perfect example. So, all of those and every country was the same where they're various ministries and departments of health would have met and how to crisis management teams for managing the pandemic. So that's one maybe for you to think about.

E16: I AI could have assisted in all of those processes because the amount of information was changing all of the time as well, and you were getting information coming in from so many government departments and then bringing all that together to come out with a portfolio of possible decisions and crisis communications and then the human factor has to come in so that they look at all of this and go, yes, let's go with us or they can merge various products of the AI structure.

E16: So, if the AI produces a certain amount of decision making or a certain amount of information or public communications, then the human decision makers need to look at this just like that. They would look at data, evidence and statistics and then decide what they're actually going to do next.

Niklas Mauer: OK. So, so kind of putting it in the COVID context, say, OK, this government took these actions for example, like a lockdown, other government focus, more on vaccination and then kind of seeing what the outcome was and base to base your own decisions on that.

E16: Yep, very much so.

Niklas Mauer: OK, perfect. Maybe regarding the time or one or two last questions. And as you mentioned earlier that the human factor is important. What I like to keep skills you would say, or leadership skills that are most important in crisis management.

E16: Very interesting questions. So, I'm researching the role of emotional intelligence in crisis leadership. At the minute I'm a I'm a part-time researcher in my first year so. Where do I start in this right? So, the human, the human factors are let. Let's sort of a better grounding first. The non-technical skills which. Practitioners and researchers would be associated with they're almost a continuum as well, so those non-technical skills and there could be many more, but mainly consist of situational awareness, decision making. Communication. Leadership. Teamwork. Dress management and fatigue monitoring. Those are the core 7 non-technical skills or human factors, and they could be subdivided so much more. OK.

E16: But I'm looking at a low over a good interest and knows I'm looking at the role of emotional intelligence in crisis leadership, because there's a significant gap in the literature. So even if we talk about leadership in general, uh, without doubt it. It's at. The unfortunate thing is, I'm sorry to go off in different tangents here, but generally people who are crisis managers might be the CEO or the deputy director of a company who have so much via financial and vested uh or sorry financial, reputational, and maybe historical and vast amount.

E16: And the company, and they automatically become the crisis managers. I done a crisis management plan and training and development for a multi million pound mine. That was it did have stakeholders, but generally there was a CEO who was a majority shareholder and he just wanted to hold everything to himself, and nobody would decide without his consent, you know? So that's hugely problematic and that's not good leadership whatsoever considering the amount of expertise and technical experts in the room. So, a leader in crisis management needs to be somebody who is extremely knowledgeable and crisis management, of course. So, they need to have that technical aspect of crisis management. It's crisis management.

E16: Again, there's an issue that some leaders are senior directors and companies think because they're in that role, that crisis management is just going to be quite simple and straightforward for them.

E16: And it's yes, I'll be the Christ manager and then they expect to do it without any training, without any education or knowledge of crisis management. And so, the leader needs to have that technical skill, but very important needs to have those non-technical skills that we just had mentioned and again needs to be fully aware of the people that he or she is working with on the situation. That's ongoing developing the team and having the crisis management team to full capability is extremely important and communication is huge within the team and of course to the wider public as well.

E16: If that's required, I could go on about this in a lot more detail, but I know we're pushed for time.

Niklas Mauer: Yeah. Yeah, kind of refreshing it. So, you have like the stuff factors. They play huge and maybe the most important role in crisis management, and this would be something to elaborate if using AI, whether it can support it or like how to integrate these soft factors as well to make good decision making.

Niklas Mauer: And so maybe as a last question and could you see like the role of AI involving in crisis management as well and maybe to yeah, even if you haven't had that many touchpoints to AI yet and how could you see like the role involving in crisis management?

E16: I think was it every aspect of and the stray and organizations. You know, technology is ever changing. World Food Program is very good World Food program also incorporates emergency telecommunications for emergencies and disasters, so there's a very innovative at department there who are always looking to try and improve and achieve more with technology.

E16: So again, I just don't have enough background, but I have no doubt that that AI will encroach into crisis and disaster management and emergency response. What that's going to look like? I'm not 100% sure I might be able to tell you better in six months' time when I when I read open this in more detail but and there are mistakes being made by the human aspect of crisis management. So, if those mistakes are ours can be eliminated through something like AI, then that's going to be hugely, hugely beneficial for all concerned.

Niklas Mauer: OK. Amazing. We will try to give you some support and show you different options to build upon that. Maybe it helps your research as well. And yeah, that's the last question. Is there like something you would like to add from your side regarding the topic regarding the interview in general?

E16: Sorry, could you repeat that Niklas, please?

Niklas Mauer: OH sure. Just to yeah, last summer and just some final boxes that like anything else you would like to add regarding the interview regarding the topic, crisis management, AI. Umm, that's this is important in your mind.

E16: Yeah, I would like to track the progress of AI in crisis management. And I mean, you're looking at a relatively new concept there, all very high in crisis management. And I will follow up and send you a jerk. It's not so much an academic journal, but it's a very good crisis management. Um. Uh, publication that comes out quarterly. And there's a researcher in there, a very, very good research. There are called **Ilan Kelman** and he has done a massive amount of research and he wrote this article.

E16: I haven't gotten around to reading it yet, but I will send it on to you, but I would be personally very interested and I have no doubt the World Food Program and I'm actually transitioning role from West Africa, two headquarters where I'll be conducting crisis management training and development exercises, so I am extremely interested to track how you're going in your research and AI in in crisis management.

E16: So please, if you can keep me in the loop of everything that's ongoing relating to AI and crisis management and just finally wish you all the best with your research, it's going to be a very relevant piece of research. I've no doubt about that. On its great down. Kudos to you for looking into it.

Niklas Mauer: Yeah, that, that we will keep you updated. They had. Would be amazing if you could forward the channel. I'm pretty sure it has valuable or valuable insights. And yeah, thanks a lot for your kind words as well. And I really like the topic. Uh. You. See where things are going and how life continues afterwards especially.

E16: Yeah, very much so. And as I read up on AI, more within crisis management, if you don't mind, I'll send you some other pieces of information and most likely they'll be subjective and then they'll be my opinion. But it'd be interesting to see. Ah, how this how this progresses somewhat more.

Niklas Mauer: No, no. That would be amazing because I'm pretty sure you have other sources and touch points to the topic or like you're involved or connected to the people or to the leaders there as I am. So, it's always a help. And yeah, I also wish you all the best with doing your research and the PhD. I suppose. Uh, yeah, I really, really, really enjoyed the talk and telling you like, just as a kind and honest person. Uh, yeah. But I would be glad if we could follow up on the topics and just in general.

E16: Great. Niklas, no problem.

Niklas Mauer: OK, perfect. Kind of need to go to the next interview, but yeah. Amazing and thanks again.

E16: Have a good day. Bye.

Description of interview situation:

Location: Online

Interview recording: Microsoft Teams conference recording was used to secure the data. Thanks to a quiet environment, high-quality audio files could be generated here. These can be accessed via the following link:

Short description of the atmosphere:

Duration of Interview: 46min

Feedback: