A preliminary analysis of high-stakes decision-making for crisis leadership

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Abstract

High-stakes decision-making is a critical component of crisis leadership. This study examined the decision-making processes of global, national and local crisis professionals to identify common decision-making process traits, and proposes a useful model to guide crisis leaders' high-stakes decision-making. Crises have distinct factors: they are time-sensitive, pose significant risks and require consequential decisions. A sample group of 15 national and international expert crisis professionals in leadership positions from national security, law enforcement and government sectors participated in this study. Seven popular decision-making models were deconstructed into 50 individual process traits and converted into a survey. The experts were asked to identify process traits from the survey that they felt best reflected their approach to decision-making. The responses of the professionals were analysed, and a new model assembled based on their expertise. The findings identified a pattern of practice across the spectrum of crisis leaders and demonstrated the potential usefulness of a new decision-making model that captures the decision-making process traits of expert crisis leaders. This research provides inexperienced crisis professionals with a model drawn from the experiences of national and global crisis experts. In addition to benefiting the novice crisis professional, the model can be used by organisations to create a personalised company crisis plan.

Keywords: crisis, decision-making, stress, leadership, crisis management, decision-making models

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INTRODUCTION

Decision-making models guide the decision-maker through the process. Of the seven models used in this study, only one, the naturalistic decision-making model (NDM), is expressly identified as a crisis-decision model. The other models have processes that can be adapted to work for a crisis; however, they were not designed

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with crises in mind. The 25-year-old NDM model relies on the crisis professional to have experience making crisis-related decisions, and use that experience, as well as 'gut instinct' to make decisions on current crises.[1] While this method may be suitable for boots-on-the-ground decision-making, like running into a burning building or firing on a suspect, leaders have found decisions based on multiple experts working through several options before acting, can save lives, and decrease the stress on the individual crisis professional. In this current climate, decisions are rarely made by a single decision maker, and it has become commonplace that leaders are turned into crisis leaders without prior crisis training and need a model created with them in mind. An example of such a professional would be a school principal experiencing an active shooter scenario.

A sample group of 15 global crisis professionals barely touches on the number of working crisis professional experts. When the members of 15-strong sample group respond individually to a 50-question survey, the sample size for factor analysis grows to 750. A small sample group such as the one in this preliminary study sheds light on the need for an up-to-date crisis decision-making model — a model that takes into consideration the psychological stressors that impact the decision-making process, and the individuals making those decisions.

Decision-making for crisis professionals involves stress not experienced by other types of decision-makers. The stress is caused by factors unique to crisis situations, or contextual factors, that influence the decision-maker, as well as the decision-making process. This paper identifies the contextual factors that influence crisis choices and the decision-making processes used by global crisis leaders in order to better understand the demands of high-stakes decision-making by crisis professionals and propose a new crisis decision-making model for both the novel and more experienced crisis leader.

Contextual factors influencing crisis leaders and high-stakes decision-making

A defining characteristic of crisis leadership is that unique contextual factors put added pressure and stress on the leader. Crisis professionals are constrained and influenced by these factors. The potential combination of multiple factors in a crisis situation increases the high-stakes nature of decision-making. Factors found in the current literature that influence crisis leaders include extreme insecurity, vulnerability, high cost (including loss of life and the potential for armed conflict and victims), greater unknowns and evolving outcomes, enemies, media, transparency, politics, stakeholders and bias.

Extreme insecurity

Insecurity is a well-documented factor affecting crisis professionals.[2–4] When a crisis leader makes a poor decision, there are multiple ramifications, from the loss of lives to losing their job. These threats can influence the choices made by the crisis leader.[5] Insecurity has prompted crisis leaders to look to others to make decisions.[6] One study found when the crisis leader was from a small town they mimicked the choices made by larger surrounding cities, assuming the spotlight would be on the city leaders.[7]

Vulnerability

The vulnerability factor has two faces: the leader's vulnerability and the vulnerability of the impacted population. One study found that when a crisis is international, and the leader believes the power is in the hands of others, they will focus on domestic issues.[8] Another study found that

when a crisis professional feels vulnerable, they give in to those with power and agree to appease them.[9] This behaviour results in increased vulnerability because those with power became very competitive to keep and even gain more power.[10] The vulnerability of populations and the cost of false alarms were found to be factors for risk leaders facing a potential crisis.[11]

High costs

The possibility of war or loss of life are factors that are unique to the crisis professional.[12–14] The mere fact that war is possible adds a layer of complexity unknown to non-crisis leaders.[15] Moreover, when decision-making is happening on a global level, the threat of war by one party is often the cause of the crisis. The possibility of loss of lives, primarily through war, is a factor that weighs heavily on the people in charge.

Public/victims

The impact of the crisis on the general public and the possible victims also plays a crucial role in crisis decision-making.[16–20] Victim management can be the most volatile of all crisis responses and exemplifies the vulnerabilities in the process. While the media may play a part in sensationalising victims, the success or failure of a crisis event depends heavily on the victims' perspectives. Crisis leadership must make victim management a significant factor in negotiation terms or when discussing options. Crisis leaders must pay attention to any children affected and be sensitive to family and cultural requirements in the aftermath of disasters of all kinds.[21] The high costs related to loss of life and victims contribute or interfere with decision-making by improving situational awareness, allowing crisis leaders to know as much as possible before deciding. Such knowledge also affects the process by limiting the possible outcomes. Leaders must also live with a decision that may increase the number of victims, even when perceived as being for the 'greater good', such as during wartime when President Truman bombed Hiroshima and Nagasaki to save half a million US soldiers.[22]

Greater unknowns and evolving outcomes

Benini[23] wrote about the high number of unknowns during a crisis, finding that the impact of limited resources and security on populations during a crisis is rarely determined at the onset, when decision-making is most important. Unknowns profoundly influence decision models and can undermine confident decision-making. Similar in impact to evolving outcomes, the crisis leader must continually adapt, having confidence that they are making the best decision at that moment. Crises present greater unknowns, requiring adaptation and fluidity in decision-making. Throughout a crisis, outcomes are continually redefined.[24,25] Because the outcomes of any decision are evolving, adjustments during the process must occur.

Enemies

Identifying the enemy is a crucial factor in crisis decision-making. Research suggests that thinking (human) and non-thinking (natural disasters) crisis antagonists affect the processes.[26] Knowing who is an enemy and how they operate guides and strengthens decision practices. An option or outcome may work for one type of enemy but not another. In military operations, the more that is known about an enemy, the better the likelihood of being able to mitigate its influence. In other words, knowing the enemy improves leaders' situational awareness.[27]

Media

Most people experience disasters through mass media.[28] At the start of the event,

there are often gaps in knowledge about the crisis. The media, in a rush to share the story, will fill the gaps with uncorroborated information. The media will also not hesitate to point out flaws in the choices made by crisis leaders. The choices of what information to share, and what to keep away from the public's eye, need to be made by the media-aware leaders. When decisions are released to the public, the media will use it to benefit their cause. Heddleston[29] argues that the public are not the only ones to benefit from mass media during a crisis. There is some evidence that videos portraying victims or The Islamic State (IS) have been particularly influential in radicalising individuals.[30–33] IS has also used the power of displaying victims, especially women or children, to make the public even more afraid. Crisis leaders need to recognise the power of the media and attempt to harness it. The media can influence decisions and the outcome of decisions.

Transparency

Transparency is an influencing factor in crisis decision-making.[34–38] Determining how much information to share with the public must be decided quickly and decisively. The ramification of sharing too much or not enough is a factor that weighs heavily on the crisis leader.[39] They must identify the amount of transparency a crisis demands and how it will affect the decision.[40] When information of an imminent crisis that may threaten lives is released, there is the potential for mass chaos, looting and mayhem. In the case of natural disasters, a leader must consider the consequences of transparency, not only for property and victims, but infrastructure, stakeholders and others, such as the city manager, mayor, police and fire departments. Transparency influences the leader by increasing the awareness of the situation and the decision process.

Transparency can be critical in crisis decision-making. One method to maintain or keep power for the crisis leader is to avoid sharing all the potential outcomes or options during the process. This lack of transparency will help guarantee the preferred outcome; however, this may lead to others questioning the motivation of the leader(s). In some crises, it may be advisable to remove transparency and negotiate behind closed doors. When the decision-making option is transparent, the crisis leader may lose the flexibility to negotiate or to reconsider alternative options. The chances for a favourable option are decreased if both options have considerable backing from others.[41] When President Kennedy threatened the Soviet Union during the Cuban missile crisis, 'remove your missiles or else', he shared only part of the information with the US public, thus gaining support for his decision and allowing the public to increase his 'power', by making the coercive threat stronger, thus leading to only two outcomes: comply or go to war.[42] President Kennedy neglected to share with the public that there was a third option, namely to remove US missiles from Turkey.[43,44]

Politics

Politics play a role in crisis decision-making.[45–48] In politics, leaders are usually in disagreement because of competition and the dispersal of power among members, hence outcomes are the consequence of a bargaining game.[49] High-stakes negotiations in politics are often unsuccessful because of the distrust and hostility felt between people seen as outsiders.[50] There is an innate fear that if the information is transparent, their adversaries will use it against them.[51] Singer[52] posits that time is an enemy in crisis decision-making: the more time spent deliberating, the greater the opportunity for trust to diminish, and fear or hostility to take over. If global

politicians make decisions based on fear and mistrust, world peace will never be obtainable.[53] The threat of war increases the vulnerability of the leader and is a factor that may not be controlled by him/her alone. Other political stakeholders may also influence decisions. The processes in the models are not directly affected by politics, but politics influence the decision-makers and consequently their choices.

Stakeholders

Stakeholders represent a factor that complicates the crisis decision process as concessions to stakeholders are required in order to secure the best possible outcome.[54–56] Crisis leaders often seek vital resources during a crisis, and those with control over the resources have control over the options.[57,58] The communities and governments affected by the crisis decision outcome are examples of invested stakeholders.

Decision-makers are answerable to many stakeholders with different needs and preferences. Those needs may not be the most socially optimal, and the leader needs to consider this.[59] On the morning of 29th August, 2005, Hurricane Katrina struck the US Gulf Coast. The choice to evacuate a city as big as New Orleans can be costly and premature decisions have cost leaders their jobs;, when the decision lingered, however, there were casualties. Crisis decision-making in this context involves multiple stakeholders.[59] The stakeholder and politics factors differ according to the constituents involved. Examples of stakeholders include residents, local business or landowners, and nonprofit humanitarian groups.

Biases

Selective bias is prevalent in the processing of new information by leaders.[60–63] Bias can influence decision-making by shaping the options and outcomes. The effects of bias can be moderated if the decision makers are aware of their biases. Bias also influences group dynamics by allowing one member's opinion to have more weight than another's, affecting decision practices as well as actual outcomes. One study found that decision-makers accepted new information only when it supported their opinion and ignored non-supporting information.[64] Participants in a crisis may be fed biased information to control outcomes.[65] The one consistent finding in crisis and non-crisis decision-making research is that heterogeneous views benefit the process, especially in mitigating bias; however, heterogeneity is not a fail-safe. Treatment of all members at the table is rarely equal, and this bias affects the distribution of power and decision outcomes. The gender of contributors is also a factor in the decision processes. Eckel and Grossman[66] found that women tend to be more risk-averse than men, and this pattern is evident in their decision-making. They found gender differences in sensitivity to the risk associated with the perception of the catastrophic potential of nuclear war, technology, radioactive waste, industrial hazards and environmental degradation. In a study by Vinson *et al.*[67] bias related to a host of human attributes — age, gender, education, marital status, occupation, and ethnicity — were found to be predictors of how people weigh in on particular issues. The crisis leader must recognise the influences of their own bias as well as biases among contributors.

Crisis professionals must have an understanding of the complexity of interacting contextual factors that raise the stakes of decision-making and influence actions a leader considers in a crisis. Extreme insecurity, high costs, greater unknowns and evolving outcomes, enemies, transparency and stakeholder politics create the context of each unique crisis and are factors that influence the decision-maker and the process.

METHODOLOGY

Purpose

The purpose of this study was to examine the decision-making processes practised by an expert panel of global, national and local crisis leaders to identify common decision-making process traits and propose a useful model to guide crisis leaders. The study was conducted using a non-experimental relational design to examine patterns in the decision-making processes of a selected sample of crisis leader experts through their responses on a survey instrument. A decision-making survey was sent to a sample of expert crisis leaders to indicate their use of 50 different decision process traits during times of a crisis. Focusing on expert decision makers, rather than less experienced decision makers, has been shown to offer more accuracy when studying complex decision-making.[68]

The study design draws on two consensus models, Delphi, and nominal group. The Delphi model involves the use of a questionnaire,[69–71] while the nominal group model is a structured, orderly procedure set out to obtain qualitative data from an expert target group.[72,73] Consensus models harness insights from appropriate experts to synthesise information and enable decisions or conclusions to be made with higher degrees of confidence.[74] They are structured, systematic, and involve panels of experts as a method to make choices.[75,76]

Survey data were loaded into Qualtrics and SPSS to conduct analysis using the descriptive statistics of frequency and percentage, the choice elimination theoretical framework and principal component analysis.[77]

Identification of target population

Definitions

In this study, the term *crisis leader* includes crisis professionals who make decisions that could result in the loss of life of others and are in a high-level decision-making position within their organisation. *Expert* was defined to include individuals who have been in their respective field for no less than ten years. The target population for this study was expert crisis leaders who met these criteria. A selected sample population of 20 experts was drawn from the target population of crisis experts and 15 experts responded. *Process traits* were defined in this research as a series of traits or characteristics of a model that differentiates one model from another and are demarcated by the authors in current literature.

Trustworthiness of information

The researcher applied procedures to control or minimise threats to the validity of the study.[78] The selection of the sample population, based on expertise as defined above, offered credibility to the data. The data were collected electronically, eliminating researcher influences on the participants.

Internal validity

Threats to internal validity were controlled by choosing target members whose positions require a high level of intelligence and discipline expertise to make high-stakes decisions. There was no loss of subjects and e-mail was used to disperse the survey, so neither mortality nor location threat existed. To increase ecological validity, the participants received the survey via e-mail. This allowed the leaders to respond in their natural environment. The threat of instrument decay was diminished using e-mail, which allowed all participants to receive the survey with identical directions on

how to proceed. There were no changes made to the survey or the instructions during this process.[79] The researcher collected the data and entered all the results. To reduce the chance of researcher fatigue, the responses from the survey's results were verified on three separate days and times by the researcher. Twenty crisis leaders were selected to participate; five did not respond. Therefore, with a 75 per cent response rate, the responding sample size was 15.

Objectivity and reliability

Seven well-known and researched decision-making models were deconstructed to generate the survey of 50 process traits. Responder fatigue is a well-documented issue that affects survey results. A responder will start a survey with enthusiasm, but by the end taper off, and respond in haste, without much thought. To prevent this phenomenon the process traits were listed in alphabetical order, thus preventing a particular model from being unfairly represented. This strategy decreased the ability of any model being favoured over another based on location in the survey. This process ensured an equally objective response to each item.

Researcher bias

The researcher was a well-known expert in the field of crisis/terrorism/weapons of mass destruction (WMD) and had professional relationships with several of the expert crisis leaders in the sample. The introduction and instructions for the survey instrument were provided via e-mail and identical for all members of the group. Following completion and receipt of the survey, a member check by telephone or e-mail was conducted to ensure that participants understood the survey items.

Sample size and selection

Twenty crisis experts were identified as a purposive, selected sample through professional affiliations in the global intelligence, government and law enforcement communities. Fifteen of the experts participated (75 per cent) in the study. This expert panel consisted of 15 senior crisis leaders from five different countries: USA, UK, South Africa, Iran and Turkey. As stated by Fraeklen and Wallen,[80] a population of 15 individuals can be defended if the group is tightly controlled; however, they also suggest future replication of the study should be considered to increase the generalisability due to the sample size and sampling method. Small sample size can lead to confounding factors, allowing an individual's decision-making process to carry more weight and affect the outcome more than in a larger sample size. Another confounding factor related to a small sample size is the effect the sample size has on the statistical analysis. This effect was mediated by confirming assumptions prior to analysis. This research was a preliminary study to test the hypothesis that current decision-making models do not adequately capture the process of high-stakes decision-making by crisis leaders and to identify shared process traits used by crisis leadership. Future research would include replication or modification with a more substantial sample to enable the generalisability of the findings.

Instrumentation

Survey data were disseminated and collected by e-mail. The survey was sent to each individual with a request that it be completed and returned in one week. This method allowed access to global and national crisis decision-making experts and permitted the experts to respond at their convenience. One of the advantages was the avoidance of confounding factors inadvertently induced by the personal interaction. One disadvantage to e-mail surveys was the lack of opportunity for the researcher to clarify instructions.

To reduce this disadvantage, the survey included a list of definitions, and there was an option for the respondent to request clarification if desired before completing the survey. No respondent requested clarification. Following completion and receipt of the survey, a member check by telephone or e-mail was conducted to ensure that participants understood the survey items. Performing a member check on the target populations of experts was essential to check for accuracy of the responses.[81]

Survey development

Seven decision-making models were chosen from the literature based on their popularity in current literature. Careful attention was paid to include samples from each of the categories as well as a blended model. When choosing sample models, diversity in types was also important. Models that allowed for group discussion versus silent voting, models that gave weight to options or outcomes, and models that allow for distance voting held significance in the selection process. The models were deconstructed into 50 identifiable process traits (see Table 1).

- naturalistic model, a decision-making model most often identified with crises;[82,83]
- rational model, an ordered and structured model that believes human beings are rational creatures;[84,85]
- political model, strategic decision-making, with the understanding that as humans (human nature), personal goals may influence the decision-making outcome;[86–89]
- multi-attribute utility analysis, a model that maps alternatives;[90–92]
- nominal group model, a structured, formal consensus model;[93,94]
- Delphi model, a questionnaire-driven long-distance model, fit for global distribution;[95–97] and
- black model, a model that assigns weight to alternatives and allows members to abstain.[98]

After deconstructing the process traits, they were alphabetised to randomise the process traits and remove the possibility of multiple items from a given model being chosen based on proximity on the survey.[99] The traits were transformed into an Adobe Acrobat survey form by adding radio buttons with options for responding: Y — yes, I use this trait in my decision-making; N — no, I do not use this trait in my decision-making; or U — I am unsure or uncertain if I use this trait. Participants were instructed to select one response for each trait. Following receipt of the survey responses, a member check by telephone or e-mail exchanges were conducted asking respondents if they had questions about items or lacked understanding of any item, and whether they wished future information about the study. Respondents did not express any issues with understanding the survey items.

Upon receipt of the completed surveys, the responses were uploaded into Qualtrics to identify frequencies in the commonality of use for each process trait.[100,101] This step produced an analysis of the shared decision process traits and what percentage of crisis leaders indicated the use of each process trait. The output from this analysis provided the data for completing a choice elimination theoretical framework. This framework was used to conduct a reduction/addition process that classified each of the seven models with the removal or inclusion of each process trait used by 80 per cent or more of the respondents. The final product revealed 13 common process traits used in decision-making by the sample of crisis leaders. This framework provided a visual display of a step-by-step process to identify shared decision-making process traits.

Table 1: The seven group decision-making models and their process traits

NDM	*PM*	*RM*	*MAUA*	*NGT*	*DT*	*BM*
Undefined goals	Needs of the members outweigh rationality	Quantitative Approach	Useful for everyday decisions	Structured, sitting around a table	No face to face meetings	Weighted responses
Needed information is missing	Goals defined by self interest	Known objectives	More than one response/ choice/ option	Writing phase, all the options on paper	Decisions made by group without contact	Member has the option to abstain
Conditions continue to change	Decision-making is seen as a battle	All options are assigned a number based on value	Results are plotted	Oral phase, sharing options without discussion	Vote is anonymous	Preferred answer or answers
Time Constraints	Power and influence weigh heavily on outcome	Assumes objective data	Each option weighed and considered	Discussion of the recorded ideas to clarify/ evaluate	Internet needed	Public choice theory, use of economic tools to analyse
High stress environment	Focus on more than one issue at a time	Formal process of analysis	Outcome decision based on plot	Conversation & debate	Sequential questionnaires	Point system
Multiple people involved	Power is decentralised	No time constraints	Time-consuming	Silent independent voting by individuals	Multiple rounds	
Organisational goals exist	Incrementalist approach	Unlimited resources to evaluate each choice		Rank ordering or rating procedure results	Time-consuming	
Decision makers are experienced	Structure of organisation influences outcome	Requires complete knowledge of information about alternatives		The 'group decision' is the pooled outcome of individual votes	The responses are shared with group prior to next round	

Note: Seven models deconstructed into 50 process traits.
NDM, naturalistic decision model; PM, political model; RM, rational model; MAUA, multi-attribute utility analysis; NGT, nominal group model; DT, Delphi model; BM, black model

To identify linear relationships among the crisis leaders' constellations of responses, the results of the survey from the 15 participants were entered into Microsoft Excel and converted from Y/U/N to 1/0/–1. These data were imported into SPSS for principal component analysis (PCA), a variable reduction technique that reduces and identifies correlated information, including the clustering of closely related constellations of variables. This method was used because it is a simple process to correlate observed variables and resembles factor analysis.[102] Through the use of PCA and the Pearson coefficient, the shared decision-making processes between the members, sub-groups and the whole group were further examined.

The methodology presented in this study involved a non-experimental relational design that examined survey response patterns in the decision-making processes of crisis leaders using descriptive statistics, the choice elimination theoretical framework, and PCA.

RESULTS

This study sprang from a hypothesis that high-stakes decision-making process traits are not adequately captured by current decision-making models. The hypothesis was provisionally confirmed by examining decision-making processes practised by an expert panel of global, national and local crisis leaders. Fifteen expert crisis leaders indicated on a 50-item survey the process traits they used in high-stakes decisions. The data were analysed using descriptive statistics, the choice elimination theoretical framework and PCA. The findings revealed 13 common process traits drawn from across current decision-making models, suggesting there may be a need to articulate a new model that better captures the practice of expert crisis leaders. PCA suggested some patterns in shared processes among the 15 crisis leaders may merit further investigation. Weak correlations were found between individuals, sub-groups and the whole group.

Three areas served as a foundation for this research: crisis leadership, factors influencing crisis decision-making and decision-making models. Crisis leadership, the factors influencing crisis decision-making and decision-making models used in this research were reviewed in detail. The results of this study are presented below.

Frequency testing

Responses to the 50-item survey were analysed using frequencies and percentages.

Distribution of shared process traits

To determine the frequency of each trait the survey results were imported into Qualtrics. Qualtrics sorted the survey process traits into three bins: Yes, I use this trait in my decision-making process; No, I do not use this trait in my decision-making process; and Unsure, I am unsure if use this trait in my decision-making process. The Qualtrics output identified frequencies in the commonality of use for each process trait (table available upon request).

Results indicated >80 per cent of the crisis professionals used 13 of the process in their decision-making. The use of 80 per cent as a cutoff was determined by generalising Pareto's distribution and assigning values to the principal; the top 20 per cent has more value than the remaining 80 per cent. One hundred per cent of the sample group used two of the process traits, 'Multiple people involved', and 'Conditions continue to change'. Furthermore, results indicated two process traits were not part of any of the leader's decision process: 'No time constraints' and 'Unlimited resources to evaluate each choice'.

The crisis leaders used process traits from a variety of the models. Five of the seven models were represented with traits used by >80 per cent of the sampled crisis leaders. The naturalistic decision model (NDM) has five process traits in the top 20 per cent. The rational model (RM), nominal group model (NGT), the political model (PM) and the multi-attribute utility analysis each contributed two process traits. The black model (BM) and the Delphi model (DT) were not represented as used by >80 per cent of the crisis leaders in this study (see Table 2). The breakdown of questions and their associated models was an indication that the alphabetising of all models' process traits during survey development was effective. High-use process traits were drawn from across five of the seven models, confirming that current models do not adequately capture current crisis decision-making processes. This analysis validated the need for a new crisis decision-making model that better captures expert crisis leaders' processes.

Table 2: Top shared traits and associated models

Trait	*# yes*	*%*	*Model*
Multiple people involved	15	100	NDM
Conditions continue to change	15	100	NDM
Assumes objective data	13	87	RM
More than one response/ choice/option	13	87	MAUA
Organisational goals exists	13	87	NDM
Rank ordering or rating procedure results	13	87	NGT
Structure of organisation influences outcome	13	87	PM
Time constraints	13	87	NDM
All options are assigned a number based on value	12	80	RM
Conversation & debate	12	80	NGT
Decision makers are experienced	12	80	NDM
Focus on more than one issue at a time	12	80	PM
Outcome decision based on plot	12	80	MAUA

Note: 80–100% crisis leaders use these traits
NDM, naturalistic decision model; PM, political model; RM, rational model; MAUA, multi-attribute utility analysis; NGT, nominal group model; DT, Delphi model; BM, black model

Shared decision-making processes

The frequencies of common process traits used in high-stakes decision-making provided a framework for a new model for decision-making for crisis leadership. The choice elimination theoretical framework (Figure 1) classifies each of the seven models and advances the removal or acceptance of each trait down the chart. If 80 per cent or more of the crisis leaders used a trait as part of their decision-making process, it was added. If a trait was used by less than 80 per cent, it was omitted. The process started with the naturalistic decision-making model because of its known use as a crisis model.

- The naturalistic decision-making (NDM) model is composed of eight process traits. Of those eight process traits, >80 per cent of the crisis leaders used only five traits. Process traits 1, 2 and 5 were omitted, while process traits 3,4,6,7 and 8 formed the foundation for the framework.
- The political model (PM) had eight process traits as well; however, only process traits 5 and 8 were added because >80 per cent of the crisis leaders used these two traits from this model.
- The rational model (RM) included two process traits (3,4) often used by the

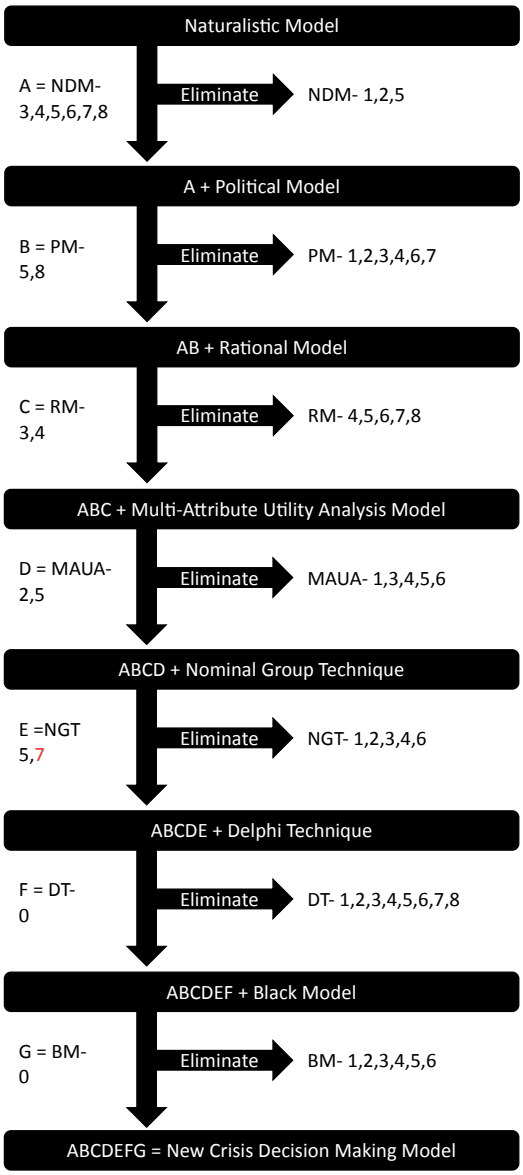


Figure 1 The choice elimination theoretical framework

crisis leaders, and four process traits that were not valuable to their process because >80 per cent of the crisis leaders used only two traits from this model.

- The multi-attribute utility analysis (MAUA) had only two process traits (2,5) used by >80 per cent of the crisis leaders.
- The nominal group model (NGT) had only two process traits (5,7) used by >80 per cent of the experts.
- The Delphi model (DT) had no traits used by >80 per cent of the crisis leaders.
- The black model (BM) had no traits used by >80 per cent of the crisis leaders.

The choice elimination theoretical framework demonstrated a reduction/addition process that classified each of the seven models with the removal of and inclusion of each process trait based on use by >80 per cent of the responding sample of crisis leaders (Figure 1). This process revealed at least 80 per cent of the sampled crisis leaders used 13 process traits drawn from across five of the seven current models. These 13 decision process traits constitute a new decision-making model for crisis leadership.

Shared decision-making processes

To determine shared decision-making process, a bivariate correlation test was performed to determine the linear relationship between two variables with a Pearson correlation. The other analysis was PCA.[102] PCA was chosen to identify shared constellations of decision processes between the individuals, sub-groups and the whole group.

Bivariate analysis and Pearson correlation

SPSS bivariate analysis identified relationships among the crisis leaders based on the 50 traits (n = 50), the Pearson correlation coefficient identifies the relationship between –1 and 1, with significance in the relationship denoted in italics (see Table 3). The results of this test demonstrated a relationship in decision processes between members of the sample group. What makes these numbers meaningful is

Table 3: PCA/Pearson correlation

	JS	*TS*	*DS*	*RM*	*EO*	*AK*	*IPC*	*CEO*	*PV*	*JB*	*DS2*	*JK*	*MR*	*IB*	*DF*
JS	1.000	0.076	0.427	0.116	0.264	0.076	–0.040	0.041	0.045	0.182	0.101	0.284	0.580	–0.040	0.008
TS	0.076	1.000	0.284	0.644	0.446	0.097	–0.060	0.122	0.330	0.074	0.264	0.544	0.183	0.327	0.328
DS	*0.427*	0.284	1.000	0.400	0.408	0.070	0.069	0.086	0.391	0.346	0.049	0.267	0.391	0.291	0.266
RM	0.116	*0.644*	0.400	1.000	0.475	0.119	0.006	0.124	0.294	0.248	0.085	0.501	0.172	0.509	0.211
EO	0.264	*0.446*	*0.408*	*0.475*	1.000	0.148	–0.130	–0.010	0.220	0.309	–0.060	0.355	0.450	0.238	0.287
AK	0.076	0.097	0.070	0.119	0.148	1.000	0.459	0.459	0.159	0.245	0.020	0.203	–0.060	0.504	0.240
IPC	–0.040	–0.060	0.069	0.006	–0.130	*0.459*	1.000	0.379	0.141	0.051	0.003	–0.050	–0.170	0.206	0.227
CEO	0.041	0.122	0.086	0.124	–0.010	*0.459*	*0.379*	1.000	0.253	0.253	–0.090	0.229	–0.010	0.418	0.231
PV	0.045	*0.330*	*0.391*	0.294	0.220	0.159	0.141	0.253	1.000	0.287	0.211	0.269	0.126	0.359	0.501
JB	0.182	0.074	*0.346*	0.248	*0.309*	0.245	0.051	0.253	0.287	1.000	0.041	0.313	0.381	0.175	0.410
DS2	0.101	0.264	0.049	0.085	–0.060	0.020	0.003	–0.090	0.211	0.041	1.000	0.129	0.188	0.053	0.232
JK	0.284	*0.544*	0.267	*0.501*	*0.355*	0.203	–0.050	0.229	0.269	*0.313*	0.129	1.000	0.425	0.261	0.292
MR	*0.580*	0.183	*0.391*	0.172	*0.450*	–0.060	–0.170	–0.010	0.126	*0.381*	0.188	*0.425*	1.000	–0.040	0.146
IB	–0.040	*0.327*	0.291	*0.509*	0.238	*0.504*	0.206	*0.418*	*0.359*	0.175	0.053	0.261	–0.040	1.000	0.225
DF	0.008	*0.328*	0.266	0.211	0.287	0.240	0.227	0.231	*0.501*	*0.410*	0.232	0.292	0.146	0.225	1.000

Note: Determinant = 0.003, italicised figures represent r >0.3

that while all of the members are experts in crisis leading, not all decision-making processes were shared.

Dimension reduction factor analysis

In the SPSS statistical software package, the data were analysed by dimension reduction factor analysis, by PCA. The PCA method summarised the information by identifying very strong inter-correlations between variables and is one of the most used exploratory data reduction procedures in the social sciences.[103] To guarantee the suitability of the information, such as sample size and the strength of the relationship, assumption tests were conducted before the analysis. Small samples mean the *r* value is less reliable and will have more variance, so additional steps are imperative. The survey was designed to address the relationship between the responders (*n* = 15) concerning their decision-making process, and this was accomplished by using 50 variables to determine the relationship. This ratio 3:1 met the minimum for factor analysis.[104]

PCA correlations

This test measures correlation among the responders, they are the variable of interest in this test. No multicollinearity or singularity was identified. (> 0.8 remove) Factor analysis is a correlation matrix that requires a large sample size to stabilise. Comrey and Lee[105] recommend a sample size of 1,000; however, a sample group of ten cases is the bare minimum to avoid computational errors. The correlation matrix, with respect to responders, identified a determinant value of 0.003. The important factor here is that the determinant is not 0. If the determinant is 0, the factor analysis will have computational problems[106] A determinant larger than 0.00001, indicates no multicollinearity. To be considered suitable, some of the correlations must have an *r* value of 0.30 or greater, but not all of the correlations must have an *r* value >0.30.[107,108] The strength of the intercorrelations with an *r* value of 0.30 or greater was considered for subgroup examination. Table 3 reports the correlations across respondents. The

number of intercorrelations at this level determines overall mutual relationships.

As seen in Table 3, the highest correlation coefficient (r value 0.644) represented a relationship in decision-making traits between a high-ranking government worker and a high-level military doctor. There was an r value of 0.475 between the same doctor and a global expert in chemical, biological, radiological and nuclear (CBRN) defence. The global CBRN expert shared traits with an US government worker ($r = 0.446$) and a high-ranking US officer ($r = 0.408$). A United Nations, non-US crisis leader, shared decision-making processes with the two US military officers. Five countries were represented in the group of 15 responders: South Africa, Turkey, United Kingdom, Iran and the USA. Other weak and moderate but significant correlations of interest among the sample set of crisis leaders are described below:

- a local emergency manager shared processes with a local fire chief;
- a counterterrorism agent from the Federal Bureau of Investigation (FBI) shared processes with several global crisis leaders, including a US military NATO emergency officer and fire chief;
- US military intelligence officer shared process traits with global, national and local leaders;
- a US military emergency department chief shared process traits with the FBI, UK and Iranian crisis leaders and US military NATO emergency officer;
- a global CBRN crisis leader shared process traits with the FBI, four US military officers and one local fire chief;
- one Iranian crisis leader shared processes with another Iranian crisis leader;
- one Iranian crisis leader shared processes with only fellow Iranians and a leader from Turkey;
- the leader from Turkey shared only with three crisis leaders from Iran;
- US military CBRN leader shared processes with a global CBRN leader, as well as other US military officers, fire and police chiefs;
- one US military medical intelligence officer (scientist) did not share processes with any other crisis leader;
- a US military NATO emergency officer/fire chief shared processes with a US military doctor and local fire chief, as well as the FBI, global and national CBRN crisis experts;
- a local fire chief shared processes with a local emergency manager and two US military officers (intelligence and CBRN);
- a local police chief shared process traits with a global UN crisis leader and the US FBI counterterrorism expert.

Validation of data

The following assumptions for PCA were made:

(1) Variables were measured at the continuous level.
(2) A linear relationship between all variables was assumed with scatter plots on random samples (process traits), variables were tested in SPSS and plots confirmed linear relationships (not shown).
(3) Sampling adequacy was measured with (1) the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy for the overall data set; and (2) the KMO measure for each individual variable.
(4) Data were deemed suitable for data reduction by Bartlett's test of sphericity.

In PCA and factor analysis, it is important that the number of samples exceeds the number of data features. Herein, X (15) samples and Y (50) data features are considered to verify that the collected data

are suitable for analysis via both methods. As a further check on data appropriateness for PCA, the following two statistical tests were performed: The KMO (0–1, 0.6 minimum value) and Bartlett's test of sphericity (p-value less than 0.05). Both tests produce a statistical measure of the appropriateness of the interrelationships and suitability of data for KMO/Bartlett).

Kaiser-Meyer-Olkin measure of sampling adequacy

KMO produces a value to reflect the overall 'fitness' of the data for factor analysis. The correlation between two variables can be influenced by the other variables. KMO measured the relationship between two variables and removed the effect of the remaining variables. This measure varies between 0 and 1, and values closer to 1 are viewed as better for factor analysis. A value of 0.5 is a suggested minimum. The KMO for this research as 0.685, verifying suitability.

Bartlett's test of sphericity

The Bartlett's test of sphericity tests the null hypothesis that the correlation matrix is an identity matrix. An identity matrix is a matrix in which all of the diagonal elements are 1, and all off-diagonal elements are 0. Taken together, these tests provide a minimum standard required before conducting a factor analysis (or a PCA). Significance was <0.005, indicating a p-value <0.01. The low p-value assured that the sample group of 15 accurately represents the population of interest. Some references counsel using Bartlett's test of sphericity only if the number of instances divided by the number of variables is lower than 5. The data contained $n = 50$ instances (50 process traits) and $p = 15$ variables (subjects: JS, TS, DS, RM, EO, AK, IPC, CEO, PV, JB, DS2, JK, MR, IB, JB). 50/15 = 3.33, which was less than 5.0.

Principal component analysis

Examining the data covariance matrix eigenvalues is one approach to determining the number of principal components or factors to retain. The horns method toolbox developed by Bigley *et al.*[109] was employed to compare various dimensionality assessment heuristics. Due to the data being on a common scale, the analysis considered the data covariance matrix to take advantage of dimensionality assessment heuristics.

Horn's curve recommends retaining two principal components or factors, while Kaiser's mean eigenvalue criterion recommends five principal components or factors, and the maximum distance secant line approach of Johnson *et al.*[110] recommends three principal components or factors. Due to Horn's method being considered more precise than competing heuristics,[111] for analysis, two principal components were visualised, and then two principal components were rotated through varimax for factor analysis.

Factor matrix for PCA

Examining the data covariance matrix eigenvalues is one approach to determining the number of principal components or factors to retain. The Factor matrix displayed the factor loadings of all variables on each factor. PCA identified them as components. For this study the components were combinations of the process traits and the variables were the crisis leaders. A factor/component is a linear combination of the original variables. The factor/component loadings are the correlation coefficients between the variables (rows) and the factors (columns) and are analogous to Pearson's r. The correlations are identified by number and colour.

The component plot in rotated space

This illustration shows the variables in the rotated factor space. It is a visual

representation of the loadings plotted in a two-dimensional space. The plot shows how closely related the traits are to each other and the two components. The relationship represented identifies a cluster of sample members' decision-making processes. What is evident here is that there is a clear demarcation of global regions and their shared processes. Crisis leaders from Iran and Turkey have shared processes. Other non-US members did not have clear segregation and appeared to be part of the USA in their clustering.

Non-parametric tests

Several nonparametric tests were run on the data, both on the process traits and the crisis leaders. Friedman's two-way analysis of variance by ranks and Kendall's coefficient of concordance each showed a significance of 0.005, and a decision to reject the null hypothesis that the distributions among the crisis leaders are the same. The one-sample Kolmogorov-Smirnov test reports a significance of <0.05 to reject the null hypothesis of a normal distribution of the crisis leaders. The second one-sample Kolmogorov-Smirnov test reported a non-uniform distribution. The one-sample runs a nonparametric test on the process traits and detects if values occur randomly above or below the –1.0 to 1.0 range. If there is no significant difference in the observed versus the random order, the null hypothesis is retained. Based on the results, the responses are random.

Summary of results: Correlations testing

PCA identified relationships between the selected sample of crisis leaders and their decision-making processes. The purpose was to elucidate whether the global leaders collectively responded similarly despite their particular fields or culture. The results suggested that there were relationships of significance. When the crisis leaders were compared, there were collective similarities and regional differences in their shared processes.

The new decision-making model

Decision-making models direct the process and guide options for choosing a course of action. Models are composed of decision process traits that create structures and/or focal points to help leaders attend to crucial contextual information and prior experiences when making decisions. This research revealed 13 process traits that construct a new model for high-stakes decision-making (see Table 4).

The choice elimination theoretical framework enabled paring down of 50 process traits seven current decision-making models to 13 traits drawn from parts of five models. The sampled crisis leaders identified 13 shared process

Table 4: New decision-making model

Situational awareness	*Group dynamics*	*Decision-making processes*
Assumes objective data	Conversation and debate	All options are assigned a number based on value
Conditions continue to change	*Decision makers are experienced*	More than one response/choice/option
Organisational goals exist	Focus on more than one issue at a time	Outcome decision based on a plot
Structure of organisation influences outcome	*Multiple people involved*	Rank ordering or rating procedure results
Time constraints		

Note: >80 per cent of the sample group of crisis leaders practise these traits when making high-stakes decisions. The NDM model processes are shown here in italics.

traits they used in their crisis decision-making. These process traits organise a leader's attention to three categories of influence: situational awareness, group dynamics and decision-making actions. For this study, three categories are drawn from current literature and are defined as follows: situational awareness is defined as an appropriate awareness of a situation;[112] group dynamics refers to the forces operating in groups;[113] decision-making actions determine how solutions or decisions are chosen.[114] The process traits do not work alone. It is the influence of the contextual factors that turn a crisis into a high-stakes crisis. Contextual factors influence the decision-makers, as well as the decision-making process (see Figure 2). Below is a discussion of how the new model works to help the leader attend to the ways the factors interface with the 13 process traits that make up the new model.

Situational awareness

Crisis leaders must recognise a need for situational awareness when making crisis decisions in the following areas: acknowledge that the conditions are not fixed and will continue to change during the decision-making process; be aware of the organisational goals and the influence the organisation has on the outcomes; and lastly, be aware of time constraints when making decisions.

Group dynamics

The crisis leaders believed that the group dynamics aid in better decision-making when multiple people (when possible, with experience) are involved; the meetings are most effective when the members are open to conversation and debate; and the group will perform at its best when focusing on more than one issue at a time.

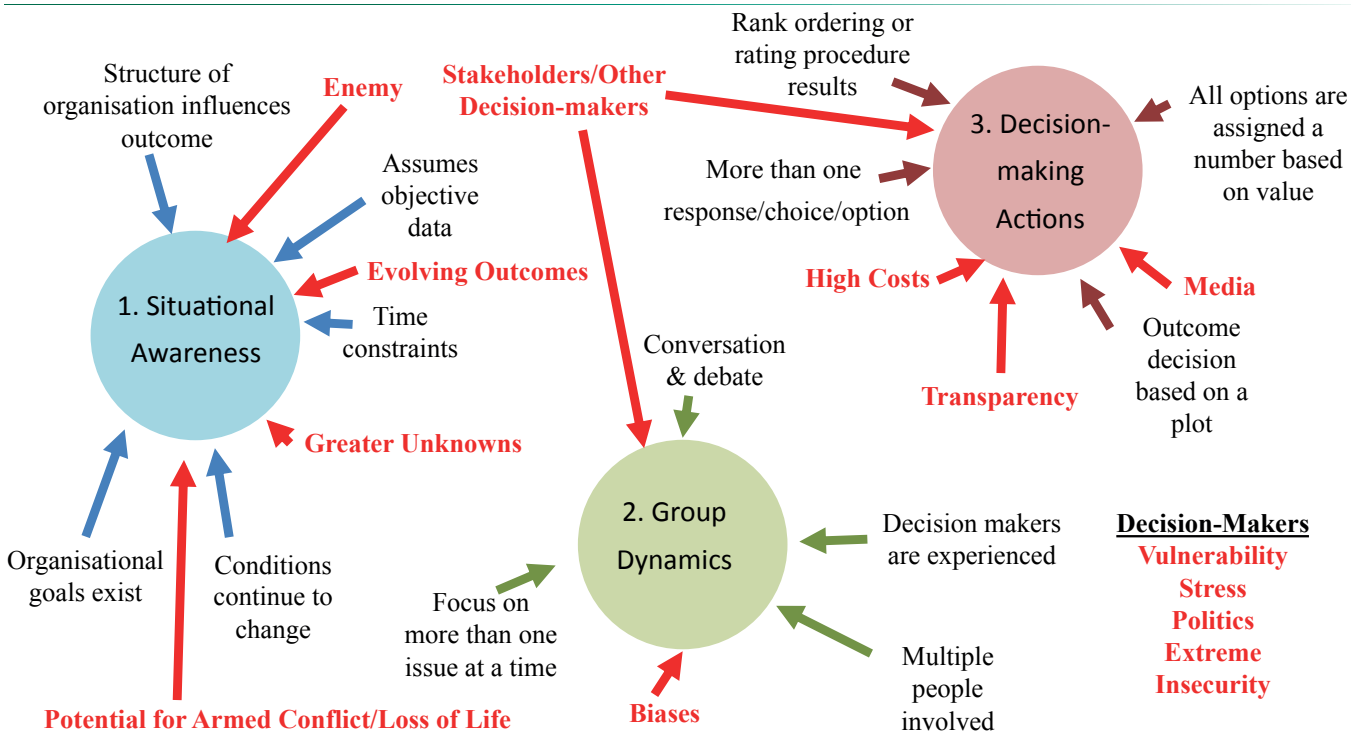


Figure 2 The three categories of the new model and their processes, and how the factors influence the decision-making at all levels

Decision-making actions

Relating specifically to the decision-making process, the experts shared that the outcome or options should be based on a plot. All decisions should be made with more than one response/choice/option. There should be a rank ordering or rating system of the options. All the options should be assigned a number based on value.

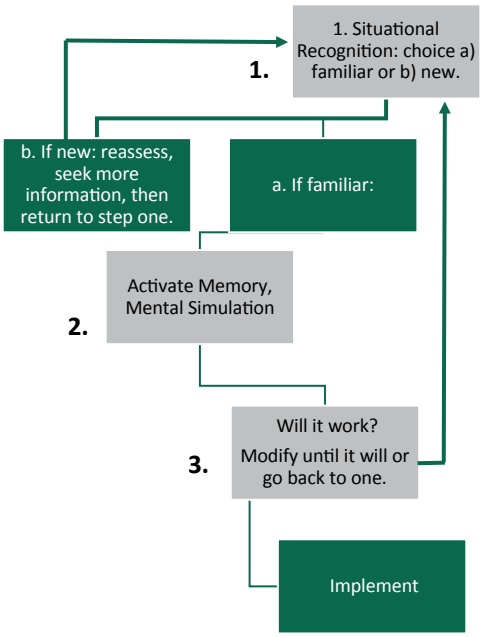
NDM vs the new model

The naturalistic decision-making (NDM) model is a 25-year-old model developed by Klein and Klinger.[115] The NDM model researchers observed decision-makers, such as firefighters and emergency room personnel. The literature suggests, and the results from this study validate, that the NDM is the model most closely aligned with how leaders make decisions in a crisis. The model is the antecedent and provides five of the 13 process traits used in the new model (see Figure 3). The NDM model has eight traits, but less than 50 per cent of the sample group found usefulness in three of the model's process traits. The NDM model has other drawbacks; it relies heavily on the experience and instincts of the crisis leader to determine the course of action. Therefore, the model does not offer assistance to the inexperienced crisis leader. Klein and Klinger[116] discuss the involvement of multiple people but highlight the experienced, individual decision-maker. Both the NDM and the new model have three categories.

Five of the NDM process traits are present in two of the categories: situational awareness and group dynamics. The third

Naturalistic Decision-making Model Process Trait	% Crisis Leaders usage
Conditions continue to change	100%
Multiple people involved	100%
Decision makers are experienced	90%
Organisational goals exists	80%
Time constraints	80%
Needed information is missing	50%
High stress environment	40%
Undefined goals	20%

A)



B)

Figure 3 (a) the naturalistic decision-making model process traits and their use by the crisis leaders; (b) the NDM model has three categories: (1) recognise the environment, (2) develop a course of action and (3) strategise

Source: Adapted from Klein, G. and Klinger, D. (1991) 'Naturalistic decision making', *Human Systems IAC Gateway*, Vol. 11, No. 3, pp. 16–19

category in the new model represents the decision-making processes and is a mathematical process rather than a mental one, as in the NDM model (see simulation in Figure 4). The four processes in the decision-making processes comprise: (1) all options are assigned a number based on value; (2) there is more than one response/choice/option; (3) the outcome decision is based on a plot; and (4) rank ordering or rating procedure results. To better appreciate the third category, the author crafted a simulation of the decision-making surrounding the Cuban missile crisis. In this figure, President Kennedy's five decision-makers (DM) have decided on six options (1). The DMs picked their favourite choices 1/2/3, no = 0. Choices

Decision-Making Actions
If Khrushchev does not remove the missiles:

1. More than one choice or option.

(DM-Decision-maker)

1. Invade Cuba
2. Invade Russia
3. Renegotiate
4. Send select troops to find the missiles
5. Nothing
6. Do A & B

2. All options are assigned a number based on value.

(DM-Decision-maker)	DM 1	DM 2	DM 3	DM 4	DM 5
1. Invade Cuba	1	0	1	2	2
2. Invade Russia	1	0	2	1	2
3. Renegotiate	3	1	2	0	2
4. Send select troops to find the missiles	2	0	3	0	3
5. Nothing	0	0	0	0	1
6. Do A & B	1	0	2	2	3

2. Rank ordering or rating procedure result.

	1st Choice	2nd Choice	3rd Choice	No
1. Invade Cuba	2	2	0	1
2. Invade Russia	2	1	1	1
3. Renegotiate	1	1	1	2
4. Send select troops to find the missiles	0	1	1	3
5. Nothing	1	0	0	4
6. Do A & B	1	2	1	1

4. Outcome decision based on a plot.

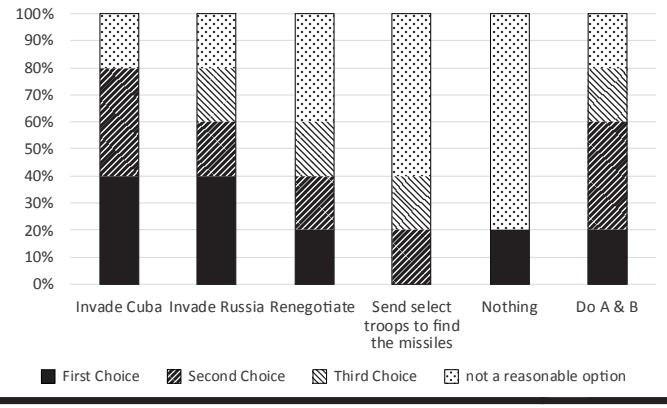


Figure 4 The new decision-making model's decision-making processes involve a four-step method, shown here as a simulation using the Cuban missile crisis

In this simulation: (1) President Kennedy's team identified six possible outcomes for this particular scenario; other scenarios, however, could have hundreds of possible outcomes. (2) Each decision-maker assigned a number value to the options, based on their preferences (ie first choice — 1, second choice — 2, and so forth). The decision-makers could also choose 0 to represent a choice they did not support. (3) The results were tallied, and the choices ranked. For this example, two members supported invading Cuba, and two members supported invading Russia as a first choice, while two members supported invading Cuba as a second choice. (4) The six outcomes were plotted. As the option to invade Cuba had greater support than the other five options, based on this simulation, had Khrushchev refused to remove the missiles, the majority of decision-makers would have supported the invasion of Cuba.

can be used more than once (2). In the next step, the options are paired with the number of DM's rankings (3) and then plotted (4). Based on this simulation, the best choice is to invade Cuba. That option will satisfy 80 per cent of the DM's first and second choices. In reality, there could be several more options, and the process could be more time-consuming, but when the stakes are high, it is important the time spent on the decision process is appropriate to the crisis.

DISCUSSION

Several careers are known to cause increased stress to the individual, but few affect the professional as much as those in crisis-related fields. Over time, professionals in a crisis field may experience a deterioration in their health and home life, including increased divorce rates, loss of sleep, exposed mental illness, post-traumatic stress disorders and suicide.[117–121] Both the breakdown of the family and health problems lead to poor decision-making, thus perpetuating the problem. If the crisis professional knows how to identify the stress factors and has guides to help in their decision-making process, their careers and home life can be improved. Validating the stress felt by the crisis professional was just one of the goals of this research.

Three areas served as a foundation for this research: crisis leadership, factors contributing to crisis decision-making and decision-making models. Research of the current literature revealed factors that affect the professional when making crisis-related decisions. This study sprang from a hypothesis that high-stakes decision-making process traits are not adequately captured by current decision-making models. To test this hypothesis, the study captured the decision-making processes of an expert panel of global, national and local crisis professionals. Expert crisis leaders' common decision-making process traits were analysed, and the research suggested that no current decision-making model adequately captured the process of high-stakes decision-making by these crisis professionals.

The literature confirmed that crisis decision-making differed from other decision-making because of the contextual factors that influence the decision process during a crisis. The individual factors interface with the decision models in various ways. The factors offer the crisis professional a greater situational awareness that will improve their decision making, such as identifying the enemy and costs. Decision-makers can also be affected by a number of factors, in particular, bias and stakeholders. Decision processes are influenced by factors such as evolving outcomes and greater unknowns. Contextual factors not only influence the models but the individual decision-makers themselves. The following factors were identified in the literature as factors that influence or are influenced by decision-makers: extreme insecurity and vulnerability; high cost, including loss of life, the potential for armed conflict, and victims; greater unknowns and evolving outcomes; enemies; media and transparency; stakeholders; bias and politics.

This study was conducted using a non-experimental relational design to examine patterns in the decision-making processes of a selected sample of crisis experts through their responses on a survey instrument. A decision-making model describes the method a person or team will use to make decisions. The models selected for this research were chosen based on their frequent citation in current literature while including a variety of diverse and representative models. Models that allowed for group discussion or silent voting, models that gave weight to options or outcomes,

and models that allowed for distance voting held significance in the selection process. The models were deconstructed into 50 identifiable process traits, and their usage identified by crisis leaders resulted in a frequency of use percentage for each process trait. Process traits were defined in this study as traits that relate to the different decision-making models as defined by their authors. The process traits were gleaned from the authors that defined the models, when possible, via published papers, or by authors that used or researched the traits. The results indicate that >80 per cent of the crisis professionals used 13 of the 50 process traits identified in this study.

Additional studies examined shared decision processes, commonly used by the 15 crisis leaders. The research identified correlations between individuals in the selected sample group and the group as a collective. Frequency analysis revealed the process traits used by >80 per cent of the crisis leaders and indicated aspects of several models represented in their decision-making. Correlation studies were performed to identify significant relationships among the sample group of crisis leaders. The correlation coefficients indicated several weak and moderate positive linear relationships between sampled crisis leaders. The strength of the correlations did not fit any pattern related to the subjects' professions but an illustration of the component plot in rotated space did indicate some regional groupings. The shared regional process traits of the component plot were corroborated with an observed noticeable trend in the shared decision processes of the global leaders from Turkey and Iran. The crisis leaders from Turkey and Iran shared process traits almost exclusively with each other, but not other global leaders. Rarely did the occupation of the leaders show similarities in the shared decision-making processes; however, in one case a global and a national CBRN crisis leader shared decision-making traits. The US FBI counterterrorism agent and a global WMD expert shared traits with global, national and local crisis leaders. This finding demonstrates the ubiquitous nature of crisis decision-making while recognising cultural trends.

FUTURE STUDIES

The use of a small sample group allowed the author to tailor future studies depending on the outcome. Potential pitfalls of the study included processes not shared, chosen models not ideal for the work, or a lack of ability to place processes into defined categories. Fortunately, the study did meet all of the criteria and allowed the work to move forward without changing models/processes.

Currently in place are workshops for crisis professionals that will allow the leader to mimic the study outlined in this paper. In groups of 15–20, the crisis professionals will fill out the questionnaire, examine results as a group, compare them with the original results, and talk through the processes. The next step is to use the new decision model as a template to create a personalised crisis management plan (CMP) that can be taken back to their organisations. In small groups, the crisis leaders will work through several table-top crisis scenarios that closely resemble what their organisation may experience and use them as their company's CMP. When a crisis hits the company, leaders can look though the book of scenarios and find one that resembles the current crisis. The company will be several stages ahead at the start of the event.

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