Consequence Management Assessment Method Synthesis for Combatant Commands

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Abstract: One of the most important roles that the US fulfills in the global war on terror and their integration with Partner Nations (PNs) is minimizing the threats and effects of weapons of mass destruction (WMD) as well as Chemical, Biological, Radiological, Nuclear and Explosive (CBRNE) attacks by enemy nations, rogue elements, or terrorist groups around the world. The Defense Threat Reduction Agency (DTRA) currently implements an assessment framework for determining a PN's state of CBRNE readiness, but it is unable to conceptualize that assessment at a regional or Combatant Command (CCMD) level. This research uses the Systems Decision Process (SDP) to create an assessment metric that is capable of synchronizing PN CBRNE readiness across a CCMD into a single assessment. This research is focused on developing an effective and flexible Microsoft Access database, which evaluates all global PNs across a wide array of metrics and then synthesizes them through multi-purpose objectives in order to develop an encompassing assessment framework at the CCMD level.

Keywords: Consequence Management, Decision Analysis, Metric Assessment, Partner Nation, CBRNE, DTRA

1. Introduction

DTRA is the U.S. Department of Defense's (DOD) official Combat Support Agency (CSA) for countering weapons of mass destruction. Part of DTRA's mission focuses on consequence assessment and mitigation of a CBRNE incident. This is done for individual PNs as well as for CCMDs. In July of 2013, the Center for National Reconstruction and Capacity Development (CNRCD) generated a Consequence Management (CM) assessment framework for assessing CBRNE preparedness in PNs. In the context of this project, CM is the ability of a nation to respond to and mitigate the effects of a CBRNE event (Bennett 2004). To make the assessments more useful and relevant, the assessments needed to evaluate the advancement of CCMD security objectives within the PNs. Subsequently, CCMD Areas of Responsibility (AOR) must be accessed holistically to provide high level readiness status based on the PN assessments comprising a CCMD's AOR. The AOR assessments are standardized and can be compared against one another. When evaluating CCMD CBRNE preparedness, consistency and standardization are important for justifying the allocation of resources. Stakeholder feedback from DTRA revealed that despite the success of the PN model, the extension of a standardized CCMD assessment method is needed.

2. Background

CM is the ability of a nation to respond to and mitigate the effects of CBRNE events (Bennett et al, 2004). This ability is critical in many scenarios, but arguably most crucial when used to mitigate the threat of detonation of a weapon of mass destruction (WMD) in a timely, effective manner. Due to the variety of complex incidents requiring an organized response, the assessment of a nation's ability to respond is crucial. CM has evolved to cover responses in complex humanitarian assistance and disaster relief operations in both foreign and domestic contaminated environments (Michalovich, 2008).

WMDs are one of the most significant threats to the US due to their ability to cause a devastatingly high amount of casualties and long term contamination of terrain and natural resources. The challenge with a nuclear or radiological event lies with the residual effects from the initial leakage or initial explosion. These residual effects can be difficult to detect in surrounding areas. The initial explosion causes damage, but the compounded nature of radiation itself affects the population for years to come.

Chemical attacks, too, have immediate effects on the population, as well as lingering contamination which can be difficult to eliminate completely. Biological, chemical, and radioactive agents may not be immediately obvious, so it is difficult to know when and where they were released (Michalovich, 2008). Compounding the immediate effects of the blast and residual localized long term natural resource contamination are the dangers associated with contamination of first responders and medical technicians. The initial responders may not have immediate outward signs of exposure and the long term effects could extend into the civilian population and subsequent generations. There is "limited scientific understanding" how these agents affect a population long term. Biological attacks can target a population through disease or affect a population's agricultural products, so it is "difficult to determine when and where they have been released" (Michalovich, 2008). Chemical and Biological attacks are complicated, vary drastically in their effects and are often difficult to predict. Because of this an effective metric to assess a country's ability to handle a Chemical or Biological attack is essential to a good CBRNE analysis metric.

Conventional explosive and secondary devices are easiest for assailants to obtain, which can cause local destruction or can be used to "disperse chemical, biological, or radiological agents" (Michalovich, 2008). Explosives are the most likely release mechanism, so dealing with hazards associated with explosives remains a top priority. Cyber terrorist attacks are an emerging form of attack that, until recently, had very little analysis or evaluation of impact and provide a significant challenge in developing a standardized response since each attack could cripple or damage different data activities. Additionally, the standardize responses that are in planned don't seem to work well.

From the perspective of the US, Security Cooperation (SC) is a method for advancing national security objectives to include CM and the prevention of the effects of WMDs through building partner nation capacity (BCP). Currently CCMDs operate relatively autonomously in their regions of responsibility. Each CCMD operates through a variety of means and encompasses multiple PNs and foreign actors who influence regional operations uniquely. However, all CCMDs follow established goals and focused objectives founded on the strategic interest of increasing US national security. One of the primary methods for increasing national security is BPC.

Increased PN capacity allows for more efficient CM efforts by reducing the resources that the US must employ in the management of a CBRNE event. Efficient use of resources for BPC is also a consideration for CCMDs. The most difficult question the US must answer is what is the effectiveness of BPC activities? To answer this question, the US has implemented a variety of assessment tools that "have become increasingly important given the current fiscal climate and budgetary limitations and the need for decision makers to know precisely where to continue, cut or change the allocation of security cooperation resources and why" (Michalovich, 2008). The US realizes the critical nature of SC in the strategic picture of its global operations and it seeks to implement it into its CM framework in order to manage its risk and exposure to CBRNE threats.

The proliferation of WMDs is one of the greatest threats to the security and stability of the US. In the modern battle space, managed by CCMDs, the US must be prepared to counter threats from terrorist actors. Proliferation of WMDs is a significant threat due to both the difficult nature of detecting individual actors who may employ the weapon and the large-scale target US military operations present (Lansing, 1999). The interaction between the US and PNs in CM operations is also of high strategic importance. CCMDs are responsible for the prevention of harmful events that jeopardize national security. Significant resources, thorough research, properly equipped personnel, and adequate funding each provides disaster relief. Interagency and international cooperation is crucial for successful mitigation of a CBRNE event to enhance SC.

2.1 Consequence Management

CM is the ability of a nation to respond to and mitigate the effects of a CBRNE event (Bennett, 2004). When more than one nation is taking action, succinct coordination is necessary across all first line responder departments. Key disasters throughout history serve as examples to reveal shortfalls and areas of improvement for coordination within CM. The Fukushima nuclear disaster highlighted both an international radiological threat and ineffective international response cooperation due to a lack of standardized reaction procedures during the incident. The Chernobyl and Bhopal incidents revealed that all parties responding to a crisis must have an increased information flow and proper risk management. The inability of private entities to control situations such as BP's inability to cap Deepwater Horizon in the Gulf of Mexico proved disastrous. Due to the vast variety of complex incidents that require an organized response, the assessment of a nation's ability to respond is crucial. CM has evolved to cover responses in complex humanitarian assistance and disaster relief operations in both foreign and domestic contaminated environments (Michalovich, 2008).

2.2 Domestic Consequence Management

The terrorist attacks on September 11, 2001 highlighted the necessity for effective CM when the US attempted to "minimize damage, loss of life, and provide emergency assistance to restore essential services" (Arrivillaga, 2008). This attack was a poignant indicator that even a world power is not immune to attack. The current US CM systems, such as FEMA and USACE, focused on state and local governments as first responders to incidents. It is the first responder's job to manage any incidents in the initial hours with the resources available before a federal response mobilizes (FEMA, 2012). This federal and local organization, along with national infrastructure, and the ease of local information sharing, gives the US a distinct advantage in its ability to respond to domestic events.

The US plans for and has specific guidelines in place that describe indicators of potential hazards. The US focuses on the prevention of attacks involving WMDs "including conventional explosives, secondary devices, and combined hazards as well as other means of attack including low-tech devices and delivery, attacks on infrastructure, and cyber terrorism" (FEMA, 2012). Guidelines for response to these events, and specific indicators of their occurrence provide a standardized method of response depending upon the type of event. This standardized response, outlined in Mirentxu and Delaney's *Consequence Management*, is crucial when transferring responsibility from the state to the federal government. The US is also highly aware of the consequence of various catastrophic events and classifies their threat level accordingly. Cyber terrorist attacks on the other hand, are an emerging form of attack that, until recently, had very little standardized response (FEMA, 2012).

Potentially, a cyber attack has the ability to disrupt financial markets and damage the economy of the US and other nations connected with us in the global economy. In connection with CBRNE, breached computer systems lead to compromised communication systems, subverted defense networks, malicious or even counterfeited goods. This allows attackers to mask, initiate, and conduct any number of attacks on a target. The Y2K incident in 2000 is a prime example of successful CM. People thought that computers would crash because of date misinterpretation by the computer's software and processes. The incident prompted the development of modern systems that focus on responding to massive computer outages (FEMA, 1999). While the development of CM systems and doctrine in response to an incident during the actual incident's duration is not ideal, in this case it resulted in a sound set of frameworks for the US to use in response to a wide array of cyber attacks. This successful CM in the US during the Y2K provides a baseline for future CCMD standardization of CM.

2.3 US Role in Foreign Consequence Management

Foreign Consequence Management (FCM) conducted by the US positively affects the international community through a multitude of methods including aid coordination for CBRNE attacks. This includes assisting in recovery, mitigating the effects of an attack and minimizing casualties (US State Department, 2014). Though the primary responsibility for event response lies with the affected nation, PNs may request a coordinated interagency response from the US (Gortney, 2012). The Department of State (DOS) controls the initiation of most FCM processes. To integrate PN assistance, the DOS FCM working group "reviews, coordinates, and monitors US Government preparedness and response activities" (US State Department, 2014). The FCM program leads the implementation of US and PN goals to ensure that the design of CBRNE prevention adequately accomplishes the FCM mission (US State Department, 2014). The US only assists PNs when the nature of the CBRNE incident is severe, the required resources are not easily available, and the time needed to engage in incident response is congruent with both US and PN objectives. Nongovernmental Organizations (NGOs), bordering nations, and foreign first responders typically intervene regardless of whether or not DOS agrees to provide aid. In these cases, the DOS is likely to be limited by any of the following situations which do not fall under its scope of operations: the failure to contain CBRNE materials, CBRNE incidents that were caused deliberately by US military operations, and CBRNE incidents which are properly contained within a DOD PN installation. The scope of FCM across all parties involved is in Figure 1.

2.4 Partner Nation Role in Foreign Consequence Management

Successful CM operations in foreign nations require the alignment of a multitude of coordination factors (clear communication of objectives, delineating areas of responsibility, synchronization of response efforts, etc.) (Dana, 2000). The difficulty in synchronizing PN's and US agencies is typically a result of delays in communication and the organization of specific CM objectives. Additionally, "the affected nation has primary responsibility for responding to, managing,

coordinating other nations' augmenting support, and mitigating the consequences of a CBRNE incident within its borders" (Gortney, 2012).

The key to a successful joint response is an increase in PN capabilities rather than replacement of those capabilities by US assets. In a general sense, many nations have a broad framework in place which addresses and outlines different CM responses to possible events in the nation as well as the US role in aiding with such incidents. The assessment and standardization of these frameworks, however, is an area that if improved, would theoretically allow for faster responses to a multitude of incidents regardless of country of origin.

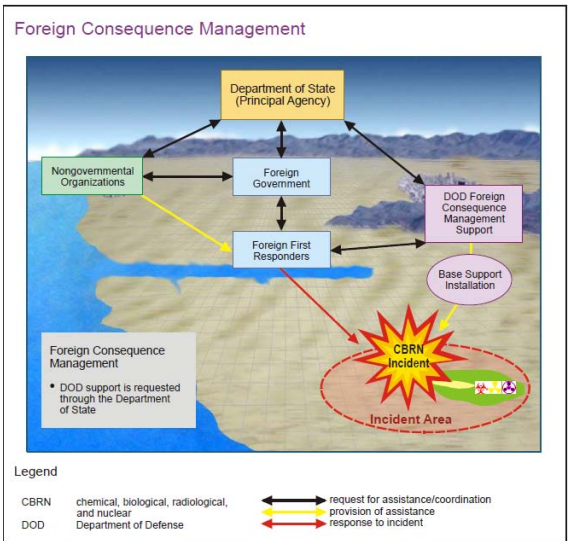

Figure 1. FCM Involvement and Scope (US State Department, 2014)

Currently the US operates in foreign nations through six phases as listed in Table 1. While there are great challenges in global crisis response and CM doctrine, there are several potent examples of past events where failed CM provides valuable insights that can be used to better prepare for tomorrow.

Table 1. Foreign Operations Phases (Gortney, 2013)

Phase	Event
0	The training and preparation of US forces for a CBRNE event
1	The deterrence of a CBRNE scenario or the preparation for a threatened event.
2	The deployment to an event that has occurred.
3	The initial arrival of US forces on scene and the type of aid provided to the affected nation.
4	The handoff of all responsibilities for managing an incident to the PN.
5	The state when all US assets have returned to their pre event posture.

2.5 Challenges

While the US has spent a significant amount of time preparing for domestic CM operations, it "and specifically the DOD and CCMDs are not optimally prepared to conduct FCM operation" (Piedmont, 2014). Despite the high activity rate of the international community in the form of treaties, agreements, and processes, there remains a lack of organization and standardization across all levels of disaster response. There are gaps between application and the implementation of a set of rules or instruments to organize information about potential threats. The limited access to information concerning an ongoing disaster as well as the populations affected causes "delays, inefficiency and inconsistency in facilitation of disaster response by states" as well as "lack of coordination within and between national and international response structures" (IDRL Asia

Pacific Unit, 2009). Without rapid dissemination of streamlined knowledge on the progression of a specific disaster, it is difficult for the responsible parties to completely and effectively organize and mitigate the occurring incident. In terms of preemptive disaster prevention, lengthy customs associated with crossing borders hinder the staging of relief efforts (Kenya Ministry of State for Special Programmes, 2009). For example, personnel and resources that are both required for effective US FCM aid, waste crucial response time due to the lengthy process of being properly inspected and cleared. The US must also consider the quality and availability of road networks and other infrastructure when transporting CM supplies and aid. A standardization of response efforts needs to occur in order to identify problems quickly and then subsequently respond efficiently. This minimizes collateral damage to both the US and PN.

2.6 Security Cooperation

From the perspective of the US, SC is a method for advancing national security objectives specifically by building partner nation capacity (US Congress, 2013). Currently CCMDs operate relatively autonomously in their regions of responsibility. Each CCMD operates through a variety of means and encompasses multiple PN and foreign actors who influence regional operations uniquely. However, all CCMDs follow established goals and focused objectives, nested on the strategic interest of increasing US national security. One of the primary methods for increasing national security is BPC.

Increased PN capacity allows for more efficient CM efforts by reducing the resources that the US must employ in the management of a CBRNE event. Taking into account the resources required for BPC is also a consideration for CCMDs. The most difficult question the US must answer is what is the effectiveness of BPC activities? To answer this question, the US has implemented a variety of assessment tools that "have become increasingly important given the current fiscal climate and budgetary limitations and the need for decision makers to know precisely where to continue, cut or change the allocation of security cooperation resources and why" (US Congress, 2013). The US realizes the critical nature of SC in the strategic picture of its global operations and it seeks to implement it into its CM framework in order to manage its risk and exposure to CBRNE threats.

2.7 Conclusion

CM and the mitigation of the fallout of CBRNE events are critical mission tasks for US CCMD. Historically, prevention of such events requires significant resources such as thorough research, properly equipped personnel, and adequate funding to provide disaster relief. Additionally, interagency and international cooperation is crucial for successful mitigation of a CBRNE event to enhance security cooperation. This requires the maintenance of open lines of communication on both the domestic and foreign levels through PNs. There are several standardized frameworks for training, assessment, and analysis of a CBRNE event. These frameworks aim to achieve a universal and timely reaction to a broad range of CBRNE events regardless of country of origin. CM is a universal process in which nations seek to prevent and minimize the effects of CBRNE events. With the universal employment of CM practices across CCMDs there needs to be an assessment framework to gauge the readiness and advancement of different CM programs at achieving US strategic objectives.

3. Methodology

The Systems Design Process (SDP) is a four-phased problem solving process that takes a holistic, iterative approach to finding a solution for the decision maker or stakeholder. The stakeholder is at the center of the SDP that places constant emphasis on value focused thinking and making decisions that add utility to the system (Figure 2). Utilizing the SDP to address improvements in the PN assessment framework included adjusting the CCMD input into PN assessments. This provides the most comprehensive approach to solving this complex problem and satisfying stakeholder needs.

Figure 2. Systems Decision Process (Parnell, 2010)

While all phases of the SDP were used to approach the issue CCMD CM assessment standardization in some extent, the first two were the primary consideration of the research. The first phase of the SDP, Problem Definition, focuses on understanding the full extent of the problem before haphazardly moving to try to create a solution. Problem Definition is centered on research and stakeholder analysis, functional and requirements analysis, and value modeling to ensure that an in-depth understanding of how the system works within its existing operating environment is gained. The outcome of the Problem Definition phase is a Redefined Problem statement explicitly defining the entirety of the existing problem. The next phase of the SDP, Solution Design, focuses on creating a solution(s) to the existing problem then has just been defined. Solution Design is driven by idea generation, alternative generation and improvement, and cost analysis. In the context of the problem we were solving, the operating environment was a large factor in the development of our solution.

Collecting background information and understanding the current assessment process are the initial steps of the problem definition phase of the SDP. The goal of this phase is to come up with a clearly defined problem statement. The process to obtain the defined problem includes the key tasks of research and stakeholder analysis, functional and requirements analysis, and value modeling. Research is valuable throughout every stage of the SDP; however, it is particularly advantageous to research early on in order to identify the functions, objectives, and boundaries of the system. Once problems are identified, a solution is necessary to take action. The initial defined problem for the CCMD CBRNE assessment is to create a CM assessment framework for CCMDs that will allow them to conduct assessments PN CBRNE readiness information. The framework is to be used to both measure the effectiveness of and identify areas of weakness within CCMD AORs. This statement generally identifies stakeholder needs, but in order to ensure that these goals are accomplished, functional and requirements analysis must be conducted, starting with the creation of a fundamental objective and literature review.

3.1. Research and Stakeholder Analysis

A review of literature as well as stakeholder interviews provides current information on the problem and the system used to collect data. The current information allows for the best understanding of stakeholder needs, wants, and desires. In addition, stakeholder interviews helped to build a foundation for understanding the work previously completed on the project. A combination of the literature review, stakeholder analysis, and previous work on this project assisted in developing a thorough understanding of the system and its challenges, including how CCMD CBRNE assessment might be implemented towards accomplishing the project objective.

3.2. Functional and Requirements Analysis

It is essential to understand the current structure of the assessments conducted by DTRA as well as the CCMD PN assessment process. A functional flow analysis gives insight to processes and relationships that dictate the structure of the system. It also shows where the project team must focus its efforts in order to maximize the impact of the research made and work put into the project during the solution implementation phase. Efforts focused on the implementation of the model and assessment framework in an easily accessible database. A synthesis of the PN nation model must be as objective and

standardized as possible, requiring a rigorous implementation of problem definition as well as the rest of the SDP to meet stakeholder needs.

3.3. Fundamental Objective

The fundamental objective is critical to the functional analysis portion of defining the problem. The establishment of a fundamental objective is derived from findings, conclusions, recommendations analysis (FCR). The FCR organizes findings from the literature review, stakeholder interviews, and analysis of similar projects into related groupings of facts to help form conclusions. The major conclusions from the research greatly enhanced the understanding of some of the dynamic problems facing DTRA. The specific findings gathered from the literature review as well as from interviews with stakeholders were compiled to develop conclusions about the current process for assessments and the desired end state. Seven major conclusions found and were grouped in logical bins to develop the following recommendations for the project:

1.) Ensure PNs and CCMDs are capable of effective CBRNE response by developing and improving assessment strategies.
2.) Develop broad value measures and weights for established evaluation protocols in order to establish a stronger, high level framework for CBRNE crisis management.
3.) Utilize framework to include Title 10 Sec 406, MDAA 1204 b. Make sure this is referred to in the literature review.
4.) Incorporate PN level excel to be managed by a (new) CCMD Access Database to include query functionality and a high-level commander style brief format for geographic region and country overview.

The four recommendations coalesced into one fundamental objective that must be satisfied in order for a solution to be feasible: *Provide an assessment framework for CCMDs' regional responsibilities, focusing on integration of PN CM of CBRNE events, through a high-level overview in order to ensure US National Security Objectives are accomplished with Section 1205 legislation.*

3.4. Functional Hierarchy

The development of a functional hierarchy (FH) is rooted in the fundamental objective. The FH identifies the system functions and sub functions that guide concept development and help define value measures. Not only will the FH enable the building of a value hierarchy but also it will serve as the foundation for the system architecture of a multi-objective decision analysis model. High-quality architecture is important for a system that is flexible to growing stakeholder needs. Therefore, the functions must be broad enough and flexible enough while still satisfying the fundamental objective. For this CM framework, the most appropriate functions are to 1) Assess Capacity Building, 2) Assess Stability, 3) Assess Effectiveness of Humanitarian Aid and; 4) Assess State of International Relations.

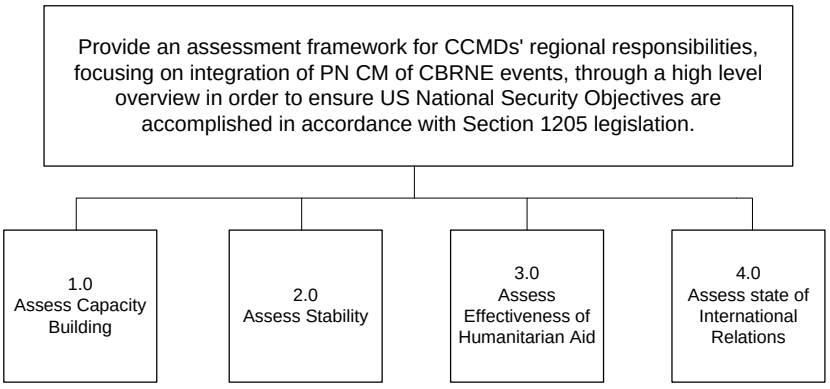

Figure 3. Functional Hierarchy

These functions were chosen through analysis of goals across all CCMDs. The Strategic Objectives of each CCMD were arranged through Affinity Diagramming brainstorm processes to ensure no stakeholder needs were left out of the model. Strategic goals such as AFRICOM's "Assist African states and regional organizations in developing the will, capability and capacity to combat transnational threats such as terrorism, piracy, and the illicit trafficking of weapons, people and narcotics" and PACOM's "enhance coordination with other geographic and functional Combatant Commands" now fit in the model under Capacity Building value measures. PACOM's "Promote and develop dynamic partnerships with the public and private sectors that facilitate joint ventures which share resources and rewards while reducing risks" strategic objective is met under the International Relations value measure category. The strategic goal of PACOM "Make a sustained series of investments and strategic decisions to strengthen U.S. military capabilities in the Asia-Pacific" fits under Assessing Stability Function and subsequent value measures. Finally, "Its humanitarian assistance and disaster relief work improves living conditions and places partner nations on a trajectory toward long term, self-sustaining capability" fits with EUROCOM's strategic objective under the Humanitarian Function and value measures. Each of their several goals falls into one of these categories within the FH (US Pacific Command, 2015).

3.5. Value Hierarchy

The defined functions of this system only become useful when there is a clear way to measure the success or failure of each. A value hierarchy is a tool that transforms the qualitative information into quantitative data. The new PN CBRNE CM assessment can then be synthesized into a succinct and objective CCMD assessment. The value hierarchy begins with the development of the supporting objects that support each function. For each of the functions, the supporting objectives address the major components of each function. For functions 1.0 and 2.0 five objectives were identified each having a number of supporting value measures (Figure 4). For functions 1.0 and 2.0, the support objectives and subsequent value measures were developed in earlier work for DTRA and established the first CM assessment model (Geary, 2013).

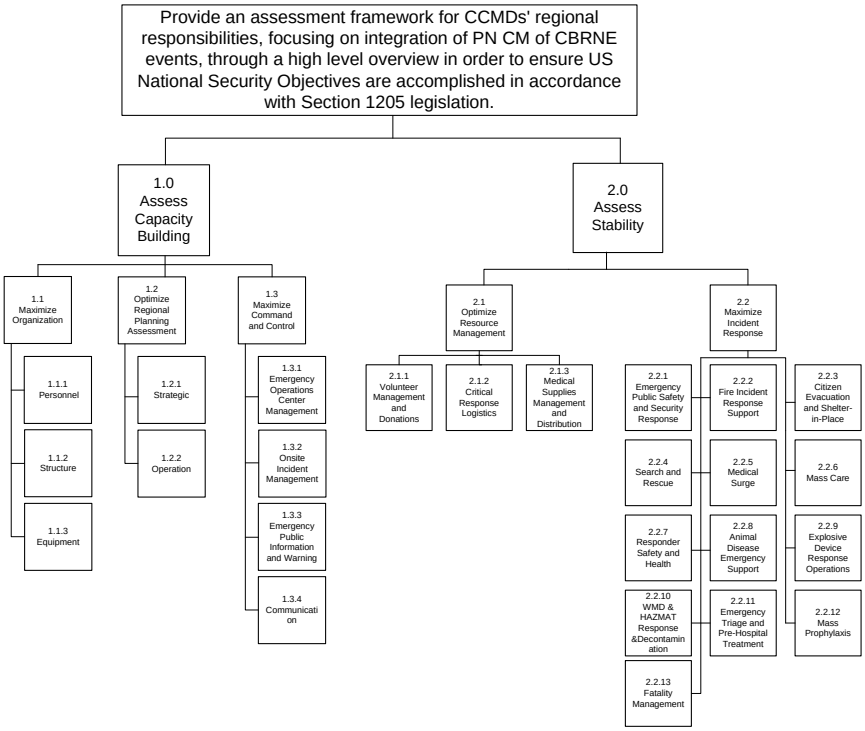

Figure 4. Value Hierarchy (Functions 1.0 and 2.0)

The model was expanded to include functions 3.0 and 4.0, which established eight more value measures. The completed value hierarchy contains multiple value measures from both DTRA and CCMD inputs for each of the objectives, establishing a detailed picture of how the functions are being accomplished. Eight additional value measures were added to the 2013 database in order to facilitate a complete analysis of each country: Financial; Logical Infrastructure; Legal System Effectiveness; Compliance with International Law; Human Rights; Governance Factor; and Governmental Procedures. This expansion was necessary to cover the gaps that the previous model did not address. The model is now more robust and holistic.

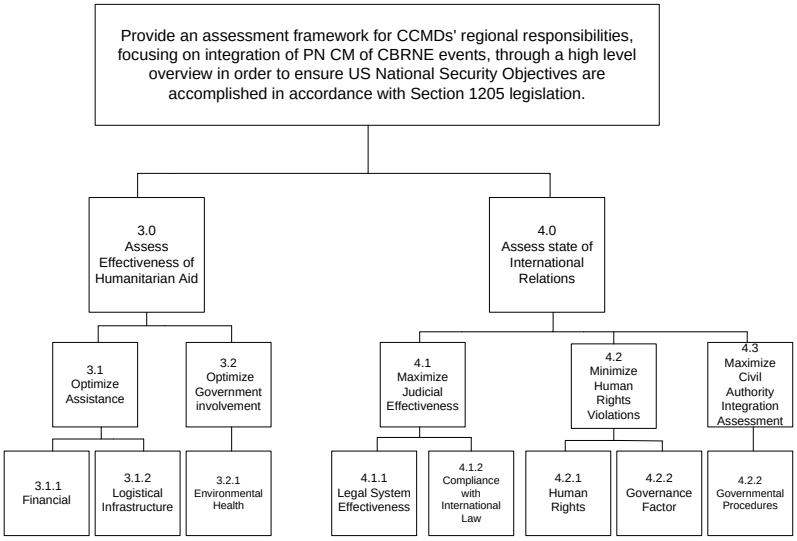

Figure 5. Value Hierarchy (Functions 3.0 and 4.0)

Financial describes the financial cost of humanitarian aid resources, and associated management and maintenance processes provided by the PN government. Logical Infrastructure describes the effective arrangement of responsibilities, authorities, and relationships among the different organizations and people, and associated policies to manage and maintain them, which facilitate collaboration to accomplish a common goal. Legal System Effectiveness measures the presence of a legal system and its effectiveness in keeping public order and mitigating crime. The metric is affected by organization, adherence to the pre established standard under that system, and its effectiveness at pursuing the legal system's established standard. Compliance with International Law shows a country's ability to adhere to mandates according to international lawmaking bodies such as the Geneva Convention and the United Nations. Human Rights validate a country's ability to maximize the occurrences and effect of human rights violations; including human rights for children, race, sex, and orientation. The Governance Factor is the country's governance factor which defines the country's ability to negate violence and give citizens natural born rights. Lastly, Governmental Procedures is the system of rules that governs civil-authority integration assessment. The additional value measures provide the model with increased assessment capabilities and further understanding of each country's performance.

3.6. Redefined Problem Statement

The initial problem statement did not account for the significant research and analysis covered in the FCR. With four recommendations factored in, the redefined problem statement should address the constraints, objectives, and functions of the entire system. The redefined problem statement is: *Develop an effective means of providing the US with a combined verifiable framework of all the CCMD's regional readiness assessments in CBRNE preparedness via optimized metrics in order to enhance security cooperation and the accomplishment of US National Security Objectives.* The redefined problem statement allows for the development of the correct solution for the correct problem.

4. Model

The final product is a MS Access model that is an effective tool for field assessment based on the value measures. The CCMD CM Assessment Model (CCAM) transforms qualitative data collected into quantitative data that can be easily understood by CCMDs and others. CCAM uses an assessment strategy that combines flexibility, capability, uniformity, standardization and adaptability into one metric that satisfies the fundamental objective in a platform with one easy user interface. DRTRA field representatives conducting PN CBRNE assessments will have the ability to employ the framework and enjoy a simple, effective model backed by systems logic that can output a country's score in seconds. If DTRA field representatives are in country and do not have access to a network, PN assessments can be recorded by other means then entered into the framework when network access is once again available. This grants an excellent degree of flexibility and ease of use for the model. The MS Access database will then compile the scores using weights and scored distributions to output the country assessment score. The assessment score can be compared with any other scored countries and will also automatically coalesce into a CCMD score for a broader strategic readiness perspective of CBRNE preparedness. This solves two of DTRA's problems, a lack of uniformity and a lack of standardization. CCAM provides a uniform and standardized method of assessment that can be applied to any situation. Finally, CCAM is adaptable. Given the ever changing strategic environment, the value weights can be updated and new value measures added to the system to reflect the strategic objectives and needs of CCMDs. CCAM combines with the new value measures and fundamental objective to provide a product that is useful to the stakeholder to assess CBRNE preparedness.

In order to visualize the data effectively, a software program built by Tableau Software Inc. was linked to CCAMS. This allowed for the construction of a digital dashboard and the ability to display multiple data streams powered by the database. The data is visualized in the dashboard through an overview screen that displays the most recent year of country assessments as well as the CCMD assessment scores and their range of values (Figure 6). This allows for the analyst to quickly and effectively understand the global situation in terms of CBRNE preparedness. The additional streams of data display current assessment scores by CCMD and World View as well as views temporally. The temporal views allow the analyst to quickly identify trends in countries over the timeframe of analysis.

4.1 Assessment

Analysts collect data in the field during evaluations of PNs. The analyst inputs the raw data into the database, and the database compiles the data to contain evaluations of all recognized countries. CCAMS evaluates the countries across a variety of metrics. Mathematically, it assigns each of the measures a weight based on its categorization in its objective group.

This categorization creates a global weight for each value measure. The database pushes that raw data through the set of swing weights and calculates each value measures value. It then calculates this value, sums, and then divides the country value by the ideal country value. It compares the country value to the ideal country value via division and this value results in a scaled country score.

Each CCMD is responsible for specific countries. A CCMD also has a preparedness score which averages the data based on the all of the country scores that are contained in the CCMD area of responsibility. This CCMD score provides valuable insight into CBRNE preparedness both regionally and globally. It allows for a high-level wave top assessment of US CCMD. This database contains quantitative data that allows for both strategic alignment decision-making as well as a time-based analysis of CCMDs.

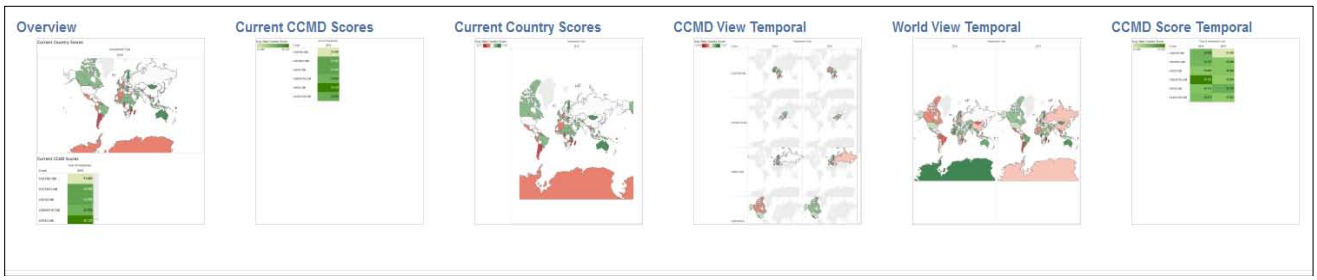

Figure 6. CM Assessment View (CCAM Displayed in Tableau Software)

The value models developed gave an in-depth view of CM that allowed for a much more accurate assessment of a PN's ability to react to a CBRNE crisis. All value measures were prescribed weights of 1-5 and given standardized instructions as to what criteria needed to be met to achieve subsequent scores with 0 being the worst and 5 being the best. In total, 33 value measures were developed and categorized under eight objectives and four functions. Every one of these value measures works to provide an accurate assessment of its objective which, in turn, assesses its function which support the fundamental objective of the value hierarchy (Figures 3-5).

5. Summary

5.1 Results

DTRA has a number of challenges with proper CM assessment: 1) a lack of uniformity; 2) lack of standardization among the CCMDs; 3) lack of adaptability. To help, CCAM was developed. CCAM is an effective tool for field assessment based on the value measures developed for DTRA to assess PN CM. CCAM uses an assessment strategy that combines flexibility, capability, uniformity, standardization and adaptability into one metric system that satisfies the fundamental objective in a platform with one easy user interface. DRTRA field representatives conducting PN CBRNE assessments will have the ability to employ the framework and enjoy a simple, effective model backed by systems logic that can output a country's score in seconds. It is flexible and easy to use. CCAM compiles the scores using weights and scored distributions to output the PN overall assessment score. The assessment score can be compared with other PNs as well as contributes to the overall CCMD score.

5.2 Conclusions

The prior research regarding PN CM assessment was solid but indicated that there was a gap in the understanding of some certain specific aspects of CM assessment. This lack of resolution limited DTRA's ability to conduct proper CM assessment. This research successfully closed some of that gap through the development of CCAM. DTRA now has a flexible and adaptable tool to allow them to conduct proper CM assessments which will allow CCMDs to make better more informed decisions concerning PN CM.

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