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Quantifying, Visualizing, and Tracking Capability Gaps

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NPS NRP Executive Summary

Quantifying, Visualizing, and Tracking Capability Gaps

Period of Performance: 01/01/2021 – 01/29/2022

Report Date: 01/04/2021 | Project Number: NPS-21-N213-A

Naval Postgraduate School, Graduate School of Operational and Information Sciences (GSOIS)



NAVAL RESEARCH PROGRAM
NAVAL POSTGRADUATE SCHOOL
MONTEREY, CALIFORNIA

QUANTIFYING, VISUALIZING, AND TRACKING CAPABILITY GAPS EXECUTIVE SUMMARY

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Project Summary

While numerous sources of information identify warfighting capability gaps and/or provide recommendations to close gaps and/or provide new/improved capabilities to the fleet, no comprehensive system, and responsible entity, captures all of that information in one place to provide a clear and concise picture of progress being made to close identified gaps and/or provide a capability. To address this problem, we developed in a previous effort, a methodology based on Multi-Criteria Decision Analysis (MCDA) methods to calculate and visualize a capability gap score at any given point in time to depict capability gap resolution progress across the elements of the Doctrine, Organization, Training, Materiel, Leadership, Education, Personnel, and Facilities (DOTMLPF) framework and based on substantiated real-time information. In this effort we expand the DOTMLPF framework used to evaluate capabilities by adding new elements and sub-elements and extend the MCDA methodology by incorporating different models for calculating the capability gap score. These models include the Weighted Sum Model (WSM), the Weighted Product Model (WPM), the Weighted Aggregated Sum Product Assessment (WASPA), the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), and the Analytic Hierarchy Process (AHP).

The goal of the effort is to develop a comprehensive methodology that would enable Navy leadership to have a clearer picture of what has been accomplished, what remains to be done, who has action, and the critical path to closing the gap and/or delivering a capability.

Keywords: *gap analysis, Multi-Criteria Decision Analysis, MCDA, data visualization*

Background

Myriad sources of information identify warfighting capability gaps and/or provide recommendations to close gaps and/or provide new/improved capabilities to the fleet. Sources that identify gaps include Warfighting Development Center Integrated Prioritized Capability Lists (IPCL), Combatant Commander Integrated Priority Lists, Navy and Joint Urgent Operational Needs Statements, Chief of Naval Operations Key Operational Problems, Navy and Joint Lessons Learned database, to name just a few. Sources that identify findings and recommendations addressing gaps include final reports of Navy and Joint war games, Fleet Experimentation program, Navy and Joint studies, Center for Naval Analysis studies, exercise after action reports, Navy and Joint Lessons Learned database, post-deployment briefs, etc. What appears to be missing is a comprehensive system, and responsible entity, that captures all that information in one place to provide a clear and concise picture of progress being made to close identified gaps and/or provide capability. To close a given gap or deliver a new capability requires action at multiple levels across the DOTMLPF spectrum. Without a comprehensive system to track all that action, Navy leadership does not have a clear picture of what has been accomplished, what remains to be done, who has action, and what is the critical path to closing the gap and/or delivering the capability.



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The methodology used for this research is based on multi-criteria decision making (MCDA) methods that consists of the following steps (Parlos, 2000): 1) Determine the relevant criteria and alternatives of a decision problem, 2) Attach weights that reflect the relative importance of the criteria on decision, 3) Rate the alternatives with respect to the criteria, and 4) Process the weights and ratings to determine a ranking of each alternative.

Findings and Conclusions

In this research effort, we extended the MCDA methodology, developed in a previous effort and used to calculate capability gap scores. The extended methodology consists of the following steps: 1) Identifying factors that influence a capability gap using an appropriate capability framework, 2) Rating capabilities on identified factors, 3) Assigning weights to identified factors, 4) Calculating a capability gap score from ratings and weights using an appropriate MCDA model, 5) Conducting a sensitivity analysis to evaluate how other ratings and weights affect the capability gap score, and 6) Visualizing capability gap scores across time and factors using a dashboard. The extended methodology uses different models for combining factor weights and capability ratings to calculate a capability gap score. These models include the Weighted Sum Model (WSM), the Weighted Product Model (WPM), the Weighted Aggregated Sum Product Assessment (WASPA), the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), and the Analytic Hierarchy Process (AHP). We also expanded and extended the DOTMLPF framework used to evaluate capabilities by adding new elements and sub-elements to the framework. We applied the developed methodology to a scenario of three programs to demonstrate the viability and applicability of the approach.

The result of the research is a comprehensive methodology that can be used to 1) support prioritization of capabilities based on hard data, 2) provide a clear and concise picture of progress being made to close identified gaps and/or provide a capability, and 3) support the creation of a central repository for organizations to distribute pertinent information.

Recommendations for Further Research

For future research efforts, we recommend continuing to refine the Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, and Facilities (DOTMLPF) capability management framework by adding new and/or modifying existing elements and sub-elements as appropriate. We also recommend applying the proposed methodology to several real-life capability scenarios and visualize the resulting gap scores across time and framework factors. Finally, we recommend developing a comprehensive dashboard, with a rich set of graphs and charts, to provide decision makers with an at-a-glance view of the status of each program across time and elements of the DOTMLPF framework.



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Acronyms

DOTMLP	Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, and Facilities
IPCL	Integrated Prioritized Capabilities List
MCDA	Multi-Criteria Decision Analysis
TOPSIS	Technique for Order Preference by Similarity to Ideal Solution
WASPA	Weighted Aggregated Sum Product Assessment
WIP	Warfare Improvement Programs
WPM	Weighted Product Model
WSM	Weighted Sum Model

