A Public Governance-Oriented Resource Constraints Management Control Mechanism in the Planning Strategy of National Defense Budgets
公共治理導向之國防預算規劃策略：建構資源限制管控機制決策模型

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Abstract

Public governance provides a basis for evaluating public sector performance, and emphasizes the principles of accountability, transparency, efficiency, effectiveness, responsiveness and rule of law, in order to achieve public benefits. In order to realize the objective of national defense strategy (defense military investment strategy and defense industries development strategy), reasonable national defense budget planning and allocation are the challenges. This study proposes a framework for an integrated public governance-oriented resource constraint management control mechanism concept, by applying decision science technology and mathematical goal programming methodology, to aid the Ministry of National Defense MND management decision making. The mainly suggestions are as follows:

I. Public Governance-oriented evaluation mechanism
II. Incorporating Resources Constraints into Mathematical Goal Programming
III. Multiple Dimension Performance Evaluation index

IV. Integration of National Defense resources and coordination via cooperation across different organizations

V. Big Data Analysis of National Defense Comptroller Cloud Information System (NDCCIS)

VI. Continuous Computer Auditing technology to strengthen the spending reviews

Keywords:Public Governance; National Defense budgets planning strategy; Resource constraints; National Defense Comptroller Cloud Information System (NDCCIS)

摘 要

公共治理爲公部門評估執行績效之基礎，主要透過課責制、透明度、效率、效能及法規遵循原則達成公共利益最大化。國防預算規劃分配合理化爲達成當前國防策略發展目標（國防軍事投資策略及國防工業發展策略）之重要挑戰。本研究提出「公共治理導向之國防預算資源限制管理控制機制」概念架構，可運用決策科學及數學目標規劃協助國防財務管理決策之參考。本概念架構主要建議：

1. 建構公共治理導向之評選機制，優化國防預算投資決策品質。
2. 建構國防資源限制（預算、人力及期程）考量之數學目標規劃決策模型。
3. 建構多維度績效衡量指標，合理評估國防預算投資效益。
4. 強化國防資源整合，建立跨組織層級溝通平台。
5. 善用國軍主財雲端資訊系統之大數據分析效益。
6. 持續性電腦稽核技術強化國防預算支出審查職能。

關鍵詞：公共治理、國防預算規劃策略、國防資源限制、主財雲端大數據、持續性電腦稽核技術

1.Introduction

With the public governance development trend spreading worldwide, the Organization for Economic Cooperation and Development (OECD) defines public governance as possessing essential characteristics, including: accountability, transparency, efficiency, effectiveness, responsiveness and rule of law. Government institutions play an important role in promoting national social and economic development. Under the international environment of threats and challenges, the Ministry of National Defense (MND) emphasizes the national strategic plans seeking to achieve the national security goals. To optimize national resource management, the National Defense Comptroller Bureau provides critical decision information to management by budget achievement and benefit analysis. Recently, public opinion and monitoring have been focusing on military affairs; the national defense comptroller should stress reasonable national defense budget planning and maintain the service quality of financial management.

The defense industries' development strategy contributes to domestic industries' technological diffusion and promotes self-reliant defense capacity. Regarding the limited national financial resources, developing a reasonable national budget scale input is a challenge. To satisfy the goals of the National Defense Act related to self-reliant defense, the national defense budget evaluation and alternatives

selection should incorporate both the decision science methodology and resource constraints consideration, realize the optimal resource allocation and improve suggestions.

Based on the public governance targets, the integrated policy formation requires research evaluation and communication, and combines public opinion and feedback (Hyndman & McKillop, 2018). The same is true for national defense budget planning; it is necessary to fulfill the operational requirements and demands for cost-effectiveness. Moreover, effective defense budget policy execution presents a severe challenge; strengthening the coordinate capacity between departments could enhance organization performance. More importantly, defense budgets policy assessment should incorporate a governance character to create the performance monitoring mechanism.

The Ministry of National Defense (MND) has implemented the Comptroller information strategy since 2013. The National Defense Comptroller Cloud Information System (NDCCIS) effectively supports the national defense comptroller process and military affairs by the main modules consisting of budget, accounting, and final account. Furthermore, the National defense comptroller bureau utilizes the NDCCIS function to plan the appropriation fund and general receipt allocation.

This study focuses on building the decision science methodology concept model for the defense industry, and investment strategy project selection and ranking. Simultaneously, applying the mathematical goal programming methodology can promote the decision-making process traceability and transparency. The remainder of this study is organized into four sections. Section 2 reviews the literature on public governance, and resource constraints. In section 3, the conceptual framework is presented. Finally, the main conclusion and management implication are proposed in section 4.

2.Literature Review

This section discusses relevant literature on public governance budget planning, the multiple dimension performance decision evaluation framework, and resources constraints concepts, respectively.

2.1 Public Governance-oriented budget planning

Public governance is important for the public sector and stockholders. Under the conditions of accountability, transparency, efficiency, effectiveness, responsiveness and rule of law, public governance consideration is needed for planning the organization's long-term strategy. Certainly, national defense budget transparency is the key factor supporting the National Defense Strategy Goal, including military investment strategy and national industries development strategy. From the accountability perspective, national defense budget planning and spending must comply with the relevant regulations. In recent years, the Government Defense Anti-corruption Index (GDAI) has become an international evaluation policy for national security. In particular, the financial risk region of GDAI indicates that the national defense budget process should build a supervision mechanism and governance standards and

establish anti-corruption to achieve the public governance goal.

2.2 Multiple dimension performance decision evaluation

This study primarily proposes multiple dimension performance criteria by decision science methodology. The main advantages of the decision science methods are the combination of qualitative and quantitative evaluation, as well as via the evaluation hierarchy construction to connect and strength the relationship of goal (national defense strategy) and alternatives (defense industry and investment strategy project). The decision science technique has been applied to many decision issues, including sustainable public transport infrastructure project (Yang, Lee and Chen, 2016), green aviation fleet program management strategy selection (Lee, Tsai, Yang & Lin, 2017), military surveillance systems (Carman & Tuncer Şakar, 2018), military airport location selection (Sennaroglu & Celebi, 2018), and so on. Therefore, the national defense strategy project possesses complexity and uncertainty; it uses the decision science evaluation framework to extract the critical success factor and to support the project budget planning efficiency.

2.3 Resources constraint mathematical programming

Goal programming (GP) technology is one of the mathematical programming tools; it provides a simultaneous solution for achieving several objectives and optimal decision selection. Considering the limitation of national defense resources, defense financial resources and manpower resource face the situation of serious insufficiency. Hence, a mathematical goal programming model will provide reasonable and adequate defense budget scales planning, benefit national budget allocations, and allocate and improve the operational process. Several academic fields has employed the GP method to solve practice decision problems, including audit risk model (Askary, Arnaout & Abughazaleh, 2018), facility location problem (Karatas & Yak1c1 , 2018), Socially Responsible Investment (Bilbao-Terol, Arenas-Parra, Canal-Fernandez & Obam-Eyang, 2018), etc. To appropriately consider the national defense resource constraints limitation, this study proposes the concept of Goal Programming to guide the innovative planning of national defense military investment and defense industries development strategy, in order to contribute suggestions to decision makers for resource allocation. Accordingly, the goal programming model priority weightings set by the science decision method (e.g. Analytic Hierarchy Process (AHP), Analytic Network Process (ANP), The Preference Ranking Organization METHod for Enrichment of Evaluations (PROMETHEE), etc.) are useful when management makes the investment strategy selection for national defense military and defense industries project under constrained resources. The GP model is described as follows:

Minimize NIP $= R_K(w_j d^+, w_j d^-)$

Subject to:

$$\sum_{j=1}^{n} r_{ij}x_j + d_i^- - d_i^+ = Q_i \qquad for\ i = 1,2,\dots,m \qquad j = 1,2,\dots,n$$

$$x_j + d_i^+ = 1 \qquad for\ i = m+1, m = 2,\dots,m+n\ ;\ j = 1,2,\dots\dots,n$$

$$d_i^+ \geq 0\ ,\ d_i^- \geq 0 \qquad for\ \forall_i \qquad x_j = 0-1 \quad for\ \forall_i$$

where NIP denotes the sum of the derivation variables from m goals considered; i indicates m restricted resources; j indicates n selected alternatives; R_K presents a preemptive priority (P1>P2>P3>>>Pk) for goal NIP; x_j indicates the binary variable of the j^{th} alternative. w_j represents the weight value by decision tool results on the j^{th} alternative; r_{ij} is the alternative parameter j of selection resource i and Q_i denotes the available resources or limitation factors that must be considered in decision making and evaluation.

3.Conceptual Framework

Based on the National Defense Strategy Goal and in seeking to promote optimal defense reform, MND strives for a defense budget increase and a built-in management and control mechanism, in order to maximize budget effectiveness.

3.1 Public Governance-oriented budget planning phase

The processing concept of this study is divided into the National Strategy Plan Phase, Budget Execution Phase, and Supervision Evaluation Phase, respectively. The conceptual framework for Public Governance-oriented National Budget Planning is illustrated in Figure 1, and each phase is discussed in turn.

- National Strategy Plan Phase

Facing the challenges related to the defense military investment scale and defense industries development investment, the science decision method and resource constraints programming can be used to extract the alternative weights and priority. By identifying the resource constraint items (e.g. budget amount, manpower, project time, etc.), the mathematical goal programming model can be established to solve the optimal alternative or portfolios.

- Budget Execution Phase

According to the public governance achievement benefits, the public sector and stockholders must comply with the legal rules and control the execution risk.

- Supervision Evaluation Phase

Traditionally, the Budget Execution Rate is the only performance index for the military sector. Connecting the evaluation criteria to the plan phase, to strengthen both the budget spending review and multiple dimension performance evaluation, benefits effective military investment.

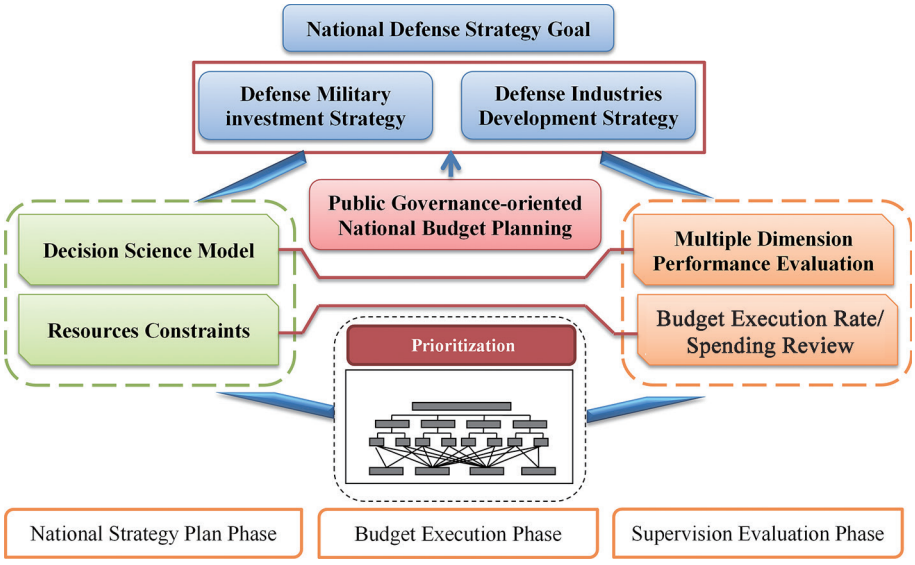

Figure 1. The concept framework of Public Governance-oriented National Budget Planning

3.2 Multiple Dimension Performance Evaluation Process with Mathematical Programming Concept framework

Yang et al. (2016) presented an activity-based costing constraint into sustainable public transport infrastructure project decisions. Simultaneously, defense military investment and defense industries development projects must realize the impact on national resource allocations. This study proposed that national resource management optimization concept framework. The mathematical optimization model developed considers the related resources (including the budget amount, manpower, and project time) and employs the weights obtained from the decision science methodology, as shown in Figure 2.

Decision Science Model Alternative Weights

National Defense Project Life Cycle Phase				
Resource Constraints	Alternative I	Alternative II	Alternative III	Goal
Budget Amount	-	-	-	-
Manpower	-	-	-	-
Project Time	-	-	-	-

Figure 2. The mathematical optimization concept model for defense industry and investment strategy project

4.Conclusion and Management implications

This study proposed a concept framework for an integrated public governance-oriented national defense budget resource constraint management control mechanism to aid MND management decision making in regard to national defense military investment and defense industries development strategy. Providing a practical application for extracting critical success factors and alternative priorities will help to build a hybrid evaluation model for achieving the national defense strategy goal. The brief results for the application of the concept model are as follows:

4.1 Public Governance-oriented evaluation mechanism

Applying the public governance principle and quality standards at the national defense organization is fundamental to evaluating national defense budget planning effectiveness and long-term national defense strategy. To meet the policy performance quality, the elements of accountability, transparency, efficiency, effectiveness, responsiveness, and rule of law must be embedded into the public governance-oriented evaluation mechanism.

4.2 Incorporating Resource Constraints into Mathematical Goal Programming

Currently, National budgets and manpower resource scarcity are challenges for national defense military investment and defense industries development. Utilizing the mathematical goal programming in the strategy decision assessment while considering the budget scales and manpower can satisfy the multi-resource constraints and optimal strategy project portfolios.

4.3 Multiple Dimension Performance Evaluation index

Between the National Strategy Plan Phase and Supervision Evaluation Phase, the multiple dimension performance criteria guide the design of the evaluation process. The advantages of multiple dimension concepts are mainly their support of the budget execution rate evaluation and analysis of the cost and benefit of strategy project investment.

4.4 Integration of National Defense resources and coordination via cooperation across different organization

Reasonable national defense resources allocation plays an important role in national defense policy performance, including force buildup, optimal military investment, defense industries development, etc. Furthermore, the national defense resource coordination platform's benefit is ensuring the consistency and transparency of the regulations and standards. The internal organization communication channels are one of the significant military operational processes that can enhance the overall efficiency of the organization.

4.5 Big Data Analysis of National Defense Comptroller Cloud Information System (NDCCIS)

Big data is a term that primarily

includes volume, velocity, and variety of data characters. The challenges have been steadily increasing in regard to data veracity, and also lower relevant decision information quality. The National Defense Comptroller Cloud Information System (NDCCIS) is employed to assist defense financial and budget spending activities. The benefits of NDCCIS are not only its support of organization internal control system effectiveness, but also the recording of daily transactions, and production of accurate financial information. More importantly, the NDCCIS function modules provide the big data analysis information to carry out the national defense comptroller value creation.

4.6 Continuous Computer Auditing technology to strengthen the spending reviews

Internal auditing is one of the missions of the National Defense Comptroller Bureau. Computer Assisted Auditing Tools and Techniques (CAATs) is an advanced analytic tool for effective organization anti-corruption. Spending reviews are primary meant to cut improper budget spending, identify the financial risk areas, and control the amount of spending scales. To extend the CAATs advantages, the continuous computer auditing technology is provided with automatic period auditing and auditing logic optimal rules to strengthen the national defense spending reviews.

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