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NAVIGATING CAPABILITY-BASED PLANNING: THE BENEFITS, CHALLENGES, AND IMPLEMENTATION ESSENTIALS

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Introduction

Capability-Based Planning (CBP) has been used in business and acquisition environments to make high-level, testable objectives to identify success criteria and/or gaps in existing capability. While both fields use the term for similar purposes, a few definitions have been proposed across literature. This paper consolidates the definitions of CBP and other relevant terms to provide an understanding of what CBP can accomplish and how to implement its principles.

Capability-Based Planning (CBP) Terminology

What are Capabilities?

Logically, the first step to understanding Capability-Based Planning (CBP) is to understand what capabilities are and the level of detail they entail. Definitions in literature break out into 4 categories: the description of objectives or high-level needs, operational outcomes, activities and processes, and the ability to produce or achieve some type of output. Below are specific definitions from the literature.

Objectives or high-level needs:

- Functional approach to the articulation of broad requirements without necessarily specifying the resources that may be involved [1]
- "Defined by an operational user and expressed in broad operational terms" [2] [3]
- "Foundation of defining the technical and operational requirements of the product or service produced by the project. Without the defined capabilities, those requirements have no reason for being" [4]
- "Consist of far more than just technology; in fact, technology underpins just one element – materiel – of a capability" [5].

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- "Capabilities are not the same as features and functions; they enable demands to be met without the explicit specification of the solution" [6], [7], [8].
- "Capabilities provide the answer to the following question: to achieve our objectives, what capabilities must we possess?" [9], [6], [7], [8].

Operational outcomes:

- "A description of the military operational output or outcome that a unit, force or organization is able (and usually constituted or organized) to deliver" [10].
- 'Define the future effects needed for agencies to meet their mission and transform into a more agile and adaptable force" [11].
- "…the combination of military equipment, personnel, logistics support, training, resources, etc. that provides Defence with the ability to achieve its operational aims" [12].

Activities and Processes:

- "… capabilities are formed through the coordination and integration of activities and processes and are the product of collective learning of individual assets" [13].
- "They are used to explore innovative new possibilities and deal with rapidly changing and uncertain conditions, and also to exploit current routines and perform repetitive processes when conditions are stable and predictable" [14].
- "Capabilities are collective and cross-functional – a small part of many people's jobs, not a large part of a few" [15].

Ability to produce or achieve some type of output:

- "Ability to achieve a desired effect under specified standards and conditions through combinations of means and ways to perform a set of tasks" [16], [2], [3], [17], [18], [19].
- "Further defined as the ability to contribute to the achievement of a desired effect in a given environment within a specified time and the sustainment of that effect for a designated period" [10].
- "Wherewithal to complete a task or produce an effect within a set of specified performance standards and environmental conditions" [20].
- "The ability to achieve an objective in a military operation" [19].

While the groups of definitions seem contradictory, combined, they imply that capabilisties are high-level descriptions of activities or features that can apply across an organization or even across the DoD. Understanding the goals of Capability-Based Planning (CBP) will demonstrate the importance of the generality of capabilities.

What is Capability-Based Planning (CBP)?

In the existing literature, definitions of Capability-Based Planning (CBP) vary widely, spanning from cross-organization planning and organization down to using user stories and scenarios. The reason is

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CBP attempts to provide a flexible framework that allows organizations or teams to identify objectives that will make them and/or what they produce successful.

For governments, CBP encourages the DoD to focus "on the development and evolution of capabilities, rather than specific programs or function" [21], to go "from programs to portfolios of capabilities" [16], [22]. The "objective is to develop a flexible, adaptable, robust, and sustainable (i.e., technically manageable and financially affordable) force structure postured to address all the challenges associated with a nation's strategic defense and security environment, considering budgets and uncertainty [20]. The "purpose is to design an appropriate force," "on developing the future force"; the "goal is to produce a future force postured to adequately deal with the challenges of the future" [20]. The "goal is to plan for robust, flexible forces, capable of meeting a wide variety of threats, rather than an 'optimal' force for a narrow set of threats" [18]. Instead of focusing on who an adversary might be and where a war might occur, need to focus more on how any adversary might fight [5], [17], [23], [22]. CBP is a "process to determine an efficient and effective mix of military forces" [20]. In summary, CBP underscores the significance of cultivating adaptable military capabilities to address future challenges in national defense by transcending the limitations of specific programs or functions.

While the following quotes pertain directly to commercial enterprises, their relevance can extend to governments or other diverse settings. CBP "is not a schedule, it's not a list of features, it's not a project management plan. It's the map to the destination of a full set of capabilities needed to transform the business from legacy applications to Enterprise Resource Planning (ERP) based operations" [4]. With CBP, "[a]n organization's planning, investments and delivery are aligned to provide the business capabilities that will deliver strategic success" [24], [25], [26], [8]. Whether at an organizational or even wider perspective (such as for a government), "[t]he key idea is to start from what needs to be done and work back to an affordable force that can do it. This is fundamentally different from starting with what you have and working out how to improve it (or keep as much of it as possible if facing cuts" [27], [28].

The previous descriptions of CBP apply to governments and corporations at a high level to help them identify the directions they need to successfully address future challenges or profit. The next set of definitions express the planning aspect of CBP's framework – while maintaining high-level generalizability to allow for innovative solutions. One of the most commonly referenced definitions of CBP comes from Paul Davis:

> *Capabilities-based planning is planning, under uncertainty, to provide capabilities suitable for a wide range of modern-day challenges and circumstances, while working within an economic framework [9].*

Essentially, CBP must "confront – rather than discount – uncertainty, to express risk in meaningful terms, and to weigh costs and benefits simultaneously" [29]. Uncertainty stems from 2 sources: both the scenarios which describe the needed capabilities and the "details of assumptions in those scenarios" [29]. Additionally, CBP should consider a diverse "range of competitive options and trade-offs before making the choices necessitated by a budget)" [29]. In other words, CBP focuses on goals and outcomes and encourages innovation [1], [16], [30], [31], [32] by "moving away from determining equipment solutions prematurely" [31], [1], [19], [30]. This "provides a means to compare different

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options for achieving the same capability" [31]. Hence, it is not the goal of CBP to "engineer planning processes to a fine level of detail, but rather to design an effective decision-support mechanism for regular, rigorous integration of planning process outputs" [5]. To support this high-level, generalizable framework, CBP "starts with a top-down definition through scenarios, case studies, or use cases" without eliciting detailed requirements [4], [25].

The generalizability of the CBP framework goes hand-in-hand with the generalizable definitions of capabilities. CBP and capabilities aim to offer flexibility while ensuring success. They acknowledge the existence of uncertainty, risks, and the opportunity and need for innovative solutions all while remaining within the constraints of feasibility and resources.

Implementing CBP: Pros, Cons, and Needs

CBP Benefits

The benefits and advantages of the high-level and generalizable framework CBP provides are, that CBP:

- enables Department of Defense (DoD) "leaders to better understand joint capability gaps, redundancies, and opportunities, providing a foundation for cross-capability tradeoffs" [16].
- has the "power to create an agency that can better adjust to new threats, eliminate stove pipes, and increase both inter and intra-agency information sharing" [11], maximizing the effectiveness of resources [29].
- "centers on the acquisition of a family-of-systems or system-of-systems that enables operations across one or more missions" [33], [17].
- "will be shown to be capable of defining what capabilities are needed for government, industry, and societal responses to a broad range of contingencies" [1].
- "allows decision makers to consider both the likelihood of the scenario occurring and any consequences of failure. It additionally permits calculations in terms of tradeoffs among Measures of Effectiveness (MOEs) (e.g., accuracy vs collateral damage vs probability of kill with one weapon) [34]. Which in turn "enhances the quality of information available to defense decision makers and defense capability developers" [11], [16], [31].
- "encourages innovation through moving away from determining equipment solutions prematurely" [31], [30], [1] and "also allows for competition among solutions" [19].
- enables "an enterprise to develop and evolve its critical capabilities in a highly complex and dynamic environment to bring superior value to its customers" [21]. This previous statement can also be extended to governments and national defenses: CBP enables a government "to develop and evolve its critical capabilities in a highly complex and dynamic environment to bring superior value to its" nation [21].

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CBP Criticisms and Challenges

CBP, while a valuable strategic approach, faces various criticisms and challenges that need to be addressed. One of the "most difficult part of" CBP is to account for uncertainty [10]. As mentioned before, there are 2 sources of uncertainty - the scenarios which describe the needed capabilities and the "details of assumptions in those scenarios" [29]. The challenge is to identify "a greater variety of scenarios" and to "effectively address the many possible scenarios and variations" [16]. Need to not only predict or account for "adversary actions, but also responses from other nations, including allies and friends" [16]. We must realize that "[i]nput-output relationships in military operations are highly complex, highly context dependent, and most military resources (people, equipment, systems, etc.) are capable of multiple functions that create different kinds of effects" [5]. While current "endeavors so far are laudable, but improvements are necessary to enhance the timeliness, responsiveness, and completeness of DoD's scenario databases" [16]. Additionally, stakeholders need to discuss the "critical uncertainties that will drive the scenario vector" [35], the exact meaning of this is never provided [10]. CBP "lacks the detailed analysis required to deal with the current realities of real future threats" [36].

In addition to accounting for uncertainties, risks, and tradeoffs, organizations and governments also need to "incorporate fiscal constraints" in CBP and "there has only been limited guidance to date on when and how such factors should be included in future force planning" [16]. One can begin to understand the complexity involved in evaluating future scenarios and capabilities needed to address them. Which leads to another challenge of the "prioritization of decisions, deciding the relative merit of requirement element and the relative importance of projects" [28].

As demonstrated in this paper, there is a "wide-range of definitions used in CBP" and there is a "need for a common CBP language to improve the community's ability to collaborate on and compare analyses" [16], [18], [28]. Though, the complexity makes the "construction of stable capability taxonomies inherently difficult" [5]. Finally, there is concern that CBP may be viewed as a one-size-fits-all solution, leading to potential issues in different contexts [28]. Thus, while CBP offers a valuable framework for strategic planning, addressing these criticisms and challenges is essential to ensure its effectiveness and adaptability in a dynamic and uncertain environment.

Needs to Implement CBP

With CBP and its advantages and disadvantages identified, this section describes what is needed to implement CBP successfully. CBP needs "collaborative strategies" to succeed [28]. "Strategic planning requires working across accountability structures to align policies, plans, and programs. Many of the current threats are cross-jurisdictional or transnational in nature" [28]. This leads to the scope of the CBP process to be broad, requiring "the involvement of many stakeholders" [1], [28]. "Stakeholder involvement must be achieved early in the process as the [they] generally control information, resources, and authority required to support CBP" [31]. It's important to remember that the outcomes of the CBP process are results of a series of decisions among stakeholders, and therefore "commitment to a strategy [is] more important than the agreement on every detail" [28]. The broad, portfolio of capabilities view that CBP encourages "requires that groups of interdependent systems must regu-

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larly interact and work together as systems of systems to deliver desired capabilities" [2]. To accomplish this, systems engineers need to be involved earlier in the "requirements and concept refinement process" of the CBP process [16].

When defining the goals for the CBP process, it is necessary to identify the "desired level of capability needed to achieve the stated objectives" [31]. "Capability goals should be developed on, amongst other considerations: defense priorities; partitions chosen; threat appreciation; scenarios used; impacts of future friendly and threat technology; affordability; risk; and concepts employed" [31]. The "portfolio-style assessment" of the CBP process must consider and account for "options at different levels of details. The portfolio-style assessments should assist in making decisions on trade-offs and should address various types of risk" [29].

The CBP processes requires for stakeholders to "think broadly about the entire scenario space of possibilities" [3], [22], [29]. "Scenarios provide the essential link between defense policy and capability objectives" [31]. While broad, high-level scenarios must be considered, considering specific scenarios help with:

- developing "realistic capability goals" [31]
- providing "context and a means to share assumptions" [28], [3] and therefore "facilitate communication" as it becomes "easier to compare options in a strategic-level framework if everyone has a fairly concrete mental image of what the evaluation cases are" [3]
- providing context for capability assessment [18] and identifying gaps associated with the mission area [19]
- "provid[ing] a way to test the concept against the breadth of the defense strategy" and "the spectrum of conditions to be considered" [19]
- "assess[ing] whether the capability at issue would merely be nice to have logically or would make a difference in plausible cases of concern [3]

Implementers of CBP also need a "framework to evaluate multiple performance indicators for capabilities and capability groups" [37] and "tools that enable visual understanding of dependencies across broad areas of interest" [16]. A common framework ("encompassing projections of risk, uncertainty, and preferences" [16]) would support collaborations and the portfolio of capabilities level of planning due to "consistency across services, Office of the Secretary of Defense (OSD), the Joint Staff, other agencies, and US allies" [16]. The CBP framework or process needs to consistently "define capability goals and identify gaps" [38] as well as be "driven by federal mandates" [11]. Implementors also need a way to "grade the DoD's abilities in [their] assessment" which requires "defining a framework for measuring how good or bad we are" [19].

Estimation plays a crucial role in decision-making processes in the CBP framework since "the most effective and efficient options to satisfy the requirements" to fill capability gaps "are sough" [9], [7], [8], [30], [39]. Estimation is particularly vital when conducting an Analysis of Alternatives within CBP. Without estimates for the potential outcomes of each choice in the list of alternatives, it becomes impossible to determine which capabilities are best suited to meet mission needs or fulfill a business case. As Alleman emphasizes, credible decisions in the face of uncertainty rely on estimates [6].

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Therefore, the accuracy and reliability of estimates are critical in ensuring that CBP can effectively inform decisions about which capabilities to pursue, aligning them with strategic objectives and mission requirements. To effectively utilize this approach, historical data on features, their attributes, actual effort, and durations are essential [40]. However, when dealing with software features, especially in a diverse landscape of operating platforms and application domains, there is a need for some form of grouping or standardization to facilitate estimation.

Meaningful Measures

When it comes to making meaningful decisions in CBP, several measures are crucial:

- Measures of Effectiveness (MOE): "Operational measures of success that are closely related to the achievements of the mission or operational objectives evaluated in the operational environment, under a specific set of conditions" [6], [34], [41], [38]. This measure allows analyzing trade-offs; for example, "accuracy vs collateral damage vs probability of kill with one weapon" [34].
- Measures of Performance (MOP): "Measures that characterize physical or functional attributes related to the system operation, measured or estimated under specific conditions" [6], [41], [38]. Another definition is a "measure of a system's performance expressed as speed, payload, range, time on station, frequency, or other distinctly quantifiable performance features" [42].
- Measure of Suitability (MOS): "A measure of an item's ability to be supported in its intended operational environment [42], [41] "Operational suitability is the degree to which a system can be placed satisfactorily in field use with consideration given to availability, compatibility, transportability, interoperability, reliability, wartime usage rates, maintainability, safety, human systems integration, manpower supportability, logistics supportability, natural environmental effects and impacts, documentation, and training requirements" [41].
- Technical Performance Measures (TPM): "Attributes that determine how well a system or system element is satisfying or expected to satisfy a technical requirement or goal [6].
- Key System Attributes (KSA): "is a system capability considered crucial in support of achieving a balanced solution approach to a Key Performance Parameter (KPP) (defined in the next bullet) or some other key performance attribute deemed necessary" [6], [41].
- Key Performance Parameters (KPP): "Key system capabilities that must be met in order for a system to deliver its operational goals" [6], [41].

Furthermore, Physical Percent Complete is a valuable measure that should increase effectiveness and performance while decreasing risk to enhance the probability of project success [43]. Additionally, there are specific measures like Measures of Force Effectiveness (MoFE) and Measures of C2 Effectiveness (MoCE) that focus on how a force performs its mission and the impact of command and control (C2) systems within the operational context, respectively [38]. Dimensional Parameters (DP) delve into the inherent properties and characteristics of physical C2 systems [38]. These measures collectively provide valuable insights for informed decision-making in CBP.

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Conclusion

Capability-Based Planning (CBP) is a multifaceted strategic approach that plays a critical role in helping organizations, including governments and corporations, navigate an ever-changing landscape of challenges and uncertainties. This paper has explored the diverse terminology associated with capabilities and CBP, discussed the advantages and disadvantages of CBP, and outlined the essential components needed for its successful implementation.

One key takeaway from this exploration is that capabilities, as defined in various contexts, provide a high-level understanding of what an organization or entity can achieve. They transcend specific technologies or solutions and serve as the foundation for effective planning and decision-making. CBP, on the other hand, offers a flexible framework that enables organizations to identify and prioritize objectives that will lead to success, all while considering the dynamic nature of the environment in which they operate.

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