

# From the Classroom to the Tip of the Spear – Designing a System to Track USMA’s Intellectual Capital

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**Abstract:** As the world becomes increasingly interconnected and unstable, the US Army’s mission becomes more complex. This reality, when coupled with a smaller force, is increasing the Army’s reliance on foreign partners and its need for non-traditional skills. Given these challenges, deployed units often offset capability gaps using “reachback,” the act of contacting external organizations for critical expertise. Based on recent support to the 1st Infantry Division in Iraq, the United States Military Academy (USMA) possesses considerable reachback potential; however, to fulfill such requests, USMA must first understand its capability and capacity. With this in mind, our research shows that although USMA’s faculty is quite willing to help deployed units, no formalized process exists to catalogue and leverage its collective intellectual capital. As such, we identify the requirement for an intuitive system to fill this void, and we develop and analyze several alternatives.

**Keywords:** Reachback, talent management, intellectual capital

## 1. Introduction

Established in 2003, knowledge management continues to grow as an Army discipline. At the 8th Annual Army Operational Knowledge Management Conference, former Chairman of the Joint Chiefs of Staff, General (ret.) Martin Dempsey explained the availability of advanced military capabilities “requires us to dominate in what we should describe as the competitive learning environment...for it is in this dimension of conflict, and our ability to learn, where victory will be decided” (2012). To this end, Army organizations must have access to the right information at the right time, and knowledge management ensures that “tacit,” or learned knowledge, becomes “explicit,” or shared knowledge. This is evident in the objective of the Army’s knowledge management principles which is “to connect those who know with those who need to know (know-why, know-what, and know-how) by leveraging knowledge transfers from one-to-many across the Global Army Enterprise” (Department of the Army, 2008). The link, and systems to make the link, between those who “know” and those who “need-to-know” is important; however, understanding *where* in the Army organization tacit knowledge exists and *how* to track its discovery also demands consideration. An excellent source of this intellectual capital is the United States Military Academy (USMA) where Army officers are educated across a plethora of disciplines. Currently, USMA supports operational units in an informal, entrepreneurial way, and this serves as a useful case study to develop a more formal reachback system.

## 2. Literature Review

Providing domestic intellectual assistance to forward deployed units is not a new concept for the Army. Unit commanders and staffs regularly approach outside experts for advice on challenging problems (Neal, 2000). However,

reachback, or “the electronic ability to exploit organic and nonorganic resources, capabilities and expertise, which by design are not located in theater,” only began to become formalized at the turn of the century (Neal, 2000, p. 39). As the Army has moved toward rapid deployments with decreased troop numbers, reachback has become more important, as increased “operational agility” has compensated for less troops. (Neal, 2000).

While informal reachback efforts may involve nothing more than a simple phone call, formal reachback is more coordinated and resource-intensive. Specifically, formal reachback occurs when a unit does not possess the resources or knowledge to solve a problem, prompting the unit to contact a central information resource to address the problem and communicate a solution (Neal, 2000). Key considerations that affect the efficacy of reachback include who can provide the necessary assistance, whether the right question is being asked, how to communicate with the reachback source, and whether the source actually helped (Neal, 2000).

In order for the reachback source to be of assistance, the researcher must have a firm understanding of his or her own capabilities. When an organization attempts to understand its own capabilities, this search for understanding falls under the disciplinary umbrella of talent management. In the corporate world, talent management is as important as any other operational aspect of the business, such as financial planning (Silzer & Dowell, 2010). Nonetheless, talent management remains a gray area. For example, in a UK survey, only 20% of the sample answered that they operated with a formal definition of talent management in mind (Collings & Mellahi, 2009). In “Talent Management for the Twenty-First Century” Peter Cappelli defines talent management as “a matter of anticipating the need for human capital and setting out a plan to meet it” (2008, p. 74). Cappelli found through his research that there are two systems that are currently in use for managing talent (2008). The first is to anticipate no needs and make no plans to meet these needs. He argues that this is the same as having no ability to manage talent for your corporation. Because there is no internal ability to meet the demand for talent, companies who follow this talent management strategy tend to outsource the majority of their work to other firms (2008). At the other end of the spectrum are companies who qualify as bureaucracies and have every asset available at their disposal. This talent management model no longer works in today’s business world, because these systems “grew up in an era when business was highly predictable . . . [and] they are inaccurate and costly” (Cappelli, 2008, p. 76). This project aims to find a healthy balance between the two that works for the Army and USMA.

### 3. Methodology

#### 3.1 Closing the Army’s Knowledge Gap – A Dynamic Illustration

In order to illustrate the value of USMA’s tacit knowledge to the operational Army, we utilized the systems dynamics modeling process (SDMP), an interdisciplinary, iterative method that portrays the behavior of complex systems by simulating the dynamics of the real world (Sterman, 2000). As seen in Figure 1, the key variable we must consider is the operational Army’s knowledge (“Army Knowledge”), or more precisely its need for it (“Gap”), which is driven by the “Demands of the Army’s Future Operational Problems” and “Operational Complexity.”

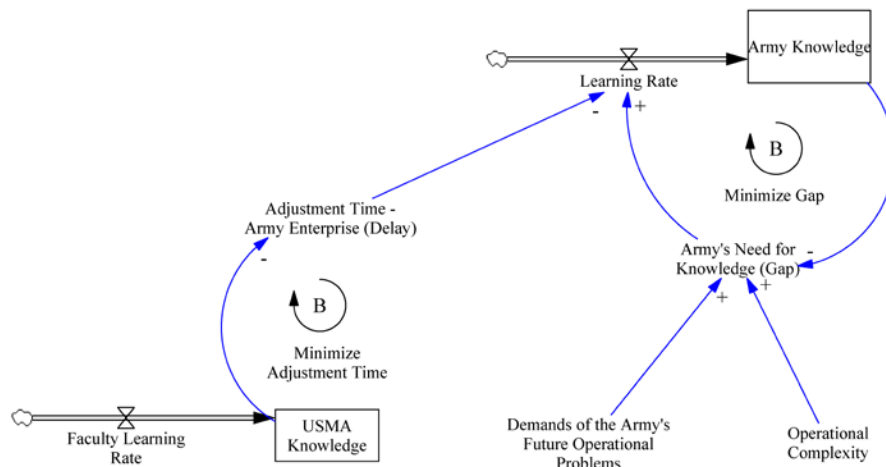


Figure 1. Systems Dynamics Model of USMA's Ability to Help Close an Emerging Knowledge Gap

Conceptually, the overall repository, or stock, of “Army Knowledge” is influenced by a “Learning Rate” flow. Although the exact time horizon is unknown, if we increase the “Learning Rate” of the operational Army, “Army Knowledge” increases, thereby decreasing the “Gap.” With this in mind, if we inject external sources of information and expertise into the operational Army, the adjustment time for it to acquire knowledge (“Delay”) should decrease.

In the context of this study, a stock of intellectual capital exists at USMA (“USMA Knowledge”) that can reduce the time to solve complex problems. In particular, the graphs depicted in Figure 2 illustrate the rate at which the Army will meet its need for knowledge – both without and with assistance from USMA. As expected, when USMA’s intellectual capital is effectively tracked and appropriately leveraged (Figure 2’s right panel), the operational Army’s “Learning Rate” increases, and demands are met faster. Armed with this observation, we turned our attention to designing a system for tracking USMA’s intellectual capital.

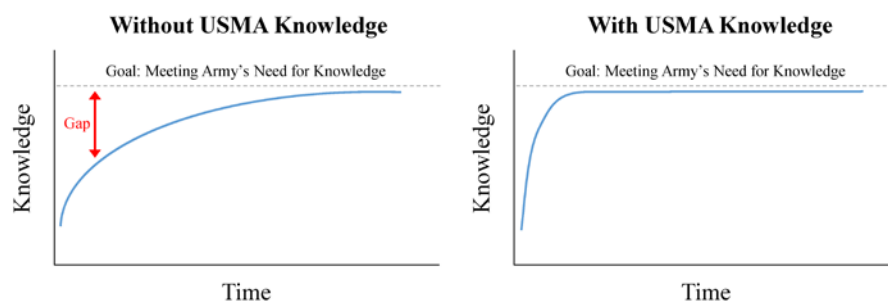


Figure 2. Fulfilling the Operational Army’s Knowledge Gap

### 3.2 Designing an Intellectual Capital Tracking System – A Decision Process

We utilized the systems decision process (SDP) to design an intellectual capital tracking system for USMA. The SDP consists of four major phases, namely: problem definition, solution design, decision-making, and solution implementation (Parnell, Driscoll, & Henderson, 2011). This phased approach allowed us to take the “current status (what is)” and transform it with a product that “delivers value to system stakeholders (what should be)” (Parnell et al., 2011). A summary of key results, by phase, is given below.

#### 3.2.1 Problem Definition

Assessing the feasibility and benefits associated with the implementation of an intellectual capital tracking system at USMA required the input of numerous experts in the field of talent management, as well as USMA’s faculty. In-person and telephonic interviews with experts such as Dr. Nicholas Olijnyk, USMA’s Digital Initiatives Librarian, and Mr. Billy Busse, the head of USMA’s Software Engineering Branch (SEB), provided insights into the technical aspects of creating the system. Additionally, discussions with USMA academic authorities, such as COL Everett Spain, Head of the Department of Behavioral Sciences and Leadership, and COL Gregory Ebner, Head of the Department of Foreign Languages, expanded the group’s knowledge of USMA’s available intellectual capital. In sum, seven 30-minute to 1-hour interviews were conducted, and these discussions provided the framework for a larger, USMA-wide survey designed to quickly gain insights into the perspectives of a significant portion of the population.

The goals of the survey were to determine the faculty’s thoughts about the creation of such a system (e.g., what features would be most valued) and to gauge their willingness to participate in reachback with deployed units. Consisting of 22 questions and distributed using the online survey software *Typeform*, the anonymous survey garnered 53 responses, including faculty from the vast majority of USMA’s academic disciplines with anywhere from 1 to over 20 years of service at USMA. As such, the sample represents a wide variety of opinions and experience among potential users, and it firmly established the need for a new system, as roughly 80% of respondents felt the “as-is” solution was inadequate. Moreover, as seen in Figure 3, the survey results were crucial in confirming the system’s value, as well as the faculty’s willingness to provide reachback. After all, nearly all respondents agreed that “documenting the expertise and experience of USMA’s faculty provides useful information,” and they expressed a willingness to populate the system with their “publication record and professional credentials.” Similarly, the

respondents were almost unanimous in their willingness to assist operational commanders, and the vast majority felt USMA had “an implicit responsibility to leverage its intellectual capital.” In short, user buy-in is not an issue.

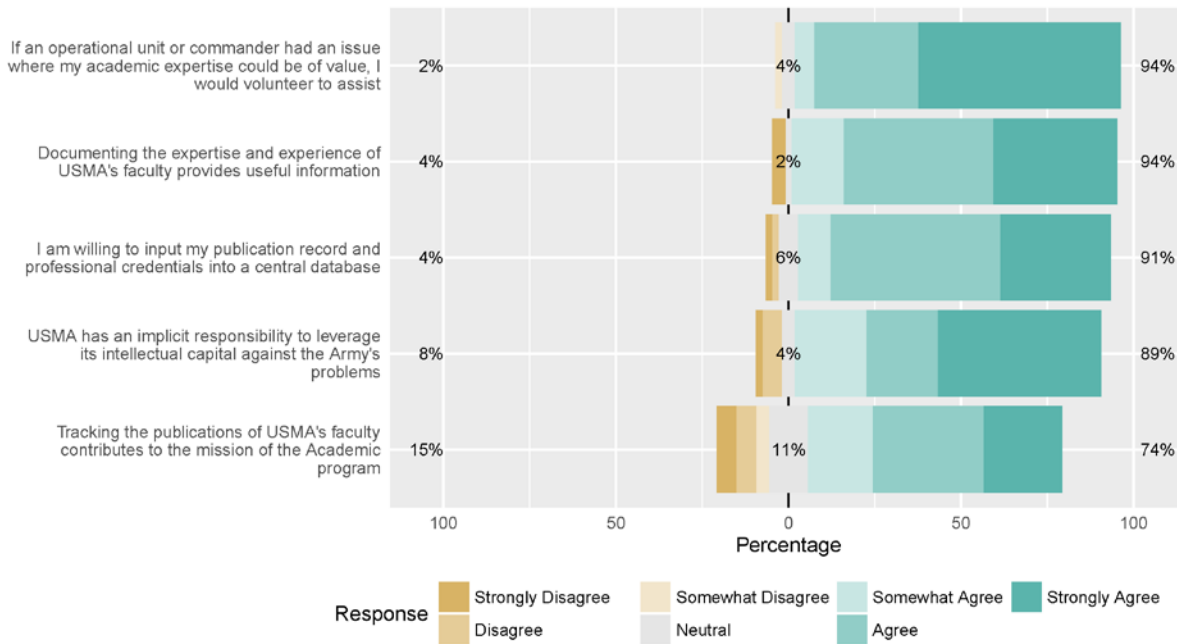


Figure 3. Key Survey Results

The presence of buy-in and a willingness to assist suggest a system should be developed. However, designing a system according to user preferences is crucial. With this in mind, the survey provided the necessary inputs to derive swing weights for the value measures seen in Figure 4. Methodologically, we scored the objectives using the “Borda Count,” a social choice method developed by Charles de Borda in 1781 which stemmed from his observation that a “candidate who beats all others in a pairwise contest can easily lose a plurality election, while a candidate who loses all such pairwise contests can still emerge as a winner in a plurality vote” (Reilly, 2002). In our case, the ten objectives in Figure 4 represent the “candidates,” and we assigned scores to each objective based on its ranking and the total number of objectives,  $n$  (Gehrlein & Plassmann, 2014). Specifically, for each of the survey’s respondents, the highest ranked objective received a score of  $n$ ; the second highest ranked objective received a score of  $n-1$ ; and the process continued until the lowest ranked objective received a score of 1. An objective’s final score was then determined by summing its scores across the respondents. For example, if a given objective was ranked first ten times and third three times, it received a score of 124. After applying the Borda Count to create a collective ranking of the objectives, we developed a Monte Carlo simulation to derive the expected weights. The ranking and associated weight for each objective is given as the ordered pair (*ranking, weight*) in Figure 4, where the weights sum to 1.

Beyond the value hierarchy and weights given in Figure 4, the principal output of the problem definition phase was a revised problem statement, to wit: *Develop a system to track West Point’s intellectual capital in order to, ultimately, connect those who know (USMA) with those who need to know (the operational Army).*

### 3.2.2 Solution Design

With a revised problem statement in hand, we turned our attention to solution design, where we applied Zwicky’s Morphological Box to generate alternative systems (Parnell et al., 2011). The design parameters in Figure 5 were selected to roughly mirror the objectives ranked by faculty in the USMA-wide survey. These alternatives were named *Status Quo*, *Status Quo with Command Emphasis*, *Individual Initiative*, *Minimum Effort/Maximum Cost*, and *Maximum Effort/Minimum Cost*. *Status Quo* represents the current system at USMA, which is an archaic, severely underutilized database. *Status Quo with Command Emphasis* aims to increase utilization via policy adjustments and oversight. *Individual Initiative* is essentially a redesigned *Status Quo*, which provides user-defined output reports that include everything from refereed journal articles to current interests. *Minimum Effort/Maximum Cost* requires USMA to hire an external developer to create the system – one

which is accessible through a public website and populated automatically with faculty publications. Finally, *Maximum Effort/Minimum Cost* represents a system created by SEB on a secure, internal website, where faculty members manually update their profiles on a quarterly basis.

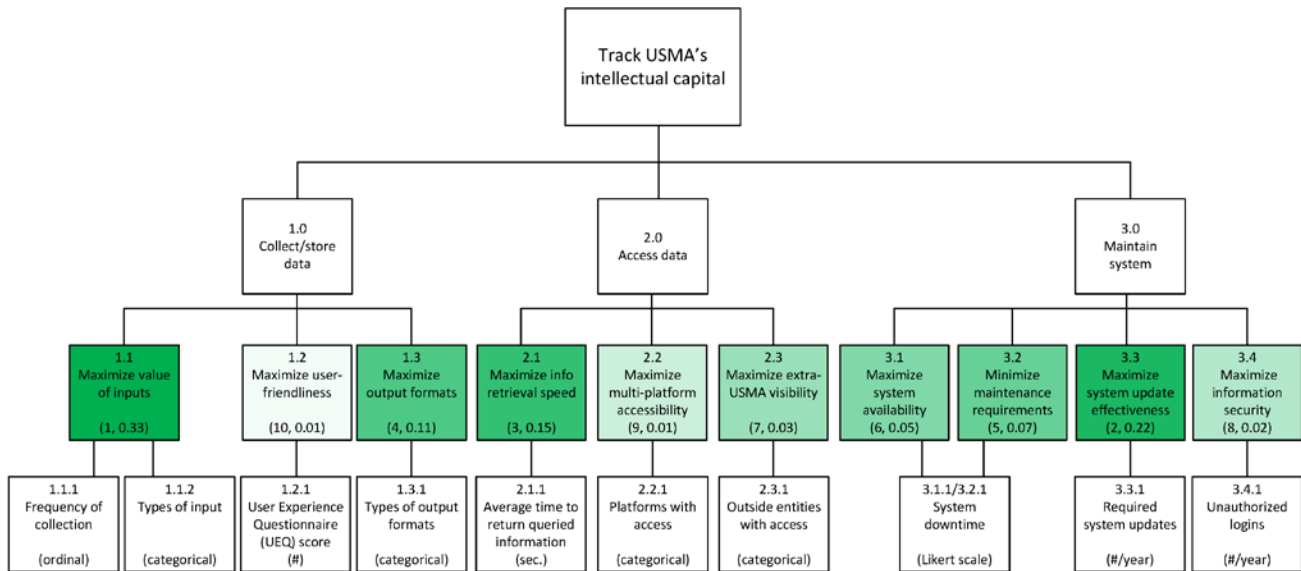


Figure 4. Value Hierarchy for USMA's Intellectual Capital Tracking System

Design Parameters								
Method of IC Collection	Frequency of Collection	Creation / Maintenance	USMA Scope	Method of Access	Command Emphasis	Type of Output	Medium of Input	
Manual Input	Concurrent with Published Date	External Contractor	All Faculty	USMA Internal Network (CAC)	Tracked	Standardized Reports	Journal Articles	
Auto Collected	Quarterly	USMA SEB	Military Faculty Only	Army Network (CAC)	Encouraged	User-Defined Reports	Conference Proceedings	
Hybrid	Once per Semester	USMA Entities (other than SEB)	Permanent Faculty Only	Username / Password	Laissez Faire	Standardized + User-Defined Reports	White Papers	
Worker Collection	Yearly	Cadet-run (Capstone)	Department Heads / Center Directors	Public Website			Current Interests	
Alternative Name		Intermittently (User Discretion)						
Status Quo	Manual Input	Yearly	USMA SEB	All Faculty	USMA Internal Network (CAC)	Laissez Faire	Standardized Reports	+ Current Interests
Status Quo with Command Emphasis	Manual Input	Once per Semester	USMA SEB	All Faculty	USMA Internal Network (CAC)	Tracked	Standardized Reports	+ Current Interests
Individual Initiative	Manual Input	Intermittently (User Discretion)	USMA SEB	All Faculty	USMA Internal Network (CAC)	Laissez Faire	User-Defined Reports	+ Current Interests
Min Effort/Max Cost	Auto Collected	Concurrent with Published Date	External Contractor	All Faculty	Public Website	Encouraged	Standardized Reports	+ Conference Proceedings
Max Effort/Min Cost	Manual Input	Quarterly	USMA SEB	All Faculty	USMA Internal Network (CAC)	Tracked	Standardized + User-Defined Reports	+ Current Interests

Figure 5. Zwicky's Morphological Box

### 3.2.3 Decision-Making

The alternatives – *Status Quo*, *Status Quo with Command Emphasis*, *Individual Initiative*, *Minimum Effort/Maximum Cost (Commercial Off-the-Shelf)*, and *Maximum Effort/Minimum Cost (Government Custom Build)* – were scored by converting raw performance data to standard units of “value” using value functions  $v(x)$  on a 0 to 100 scale (Parnell et al, 2011). For example, consider Figure 6, which portrays the value function for value measure 1.1.2 – *Types of Input*.

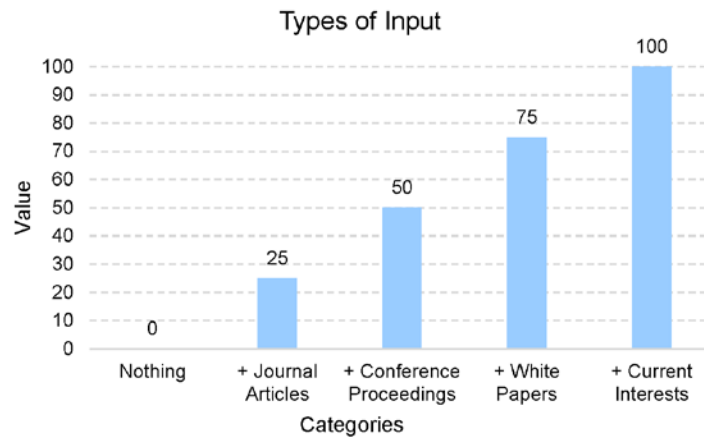


Figure 6. Value Function for Value Measure 1.1.2 – Types of Input

Logically, the more types of input an organization’s intellectual capital tracking system can accept the better. As such, if the system accepts no input from USMA’s faculty, then it provides no value; “Nothing” maps to 0. On the other hand, if the system accepts all types of faculty input, from refereed journal articles to unpublished white papers and current interests, then it serves as a rich, encyclopedic repository of USMA’s intellectual capital. This is the ideal situation; thus, “+ Current Interests” maps to the maximum value score of 100. The remaining nine value functions worked in a similar manner.

Value Measure	Objective	Weight	Alternatives				
			Status Quo	Status Quo with Command Emphasis	Individual Initiative	Min Effort/Max Cost (Off-the-Shelf)	Max Effort/Min Cost (Custom)
Frequency of Collection	1.1 Maximize value of inputs	0.33	0	U(50,75)	U(0,25)	U(75,100)	U(75,100)
Types of Input			25	25	25	75	100
UEQ Score	1.2 Maximize user-friendliness	0.01	U(0,50)	U(0,50)	U(0,50)	U(75,90)	U(80,100)
Types of Output Formats	1.3 Maximize output formats	0.11	30	30	30	U(90,100)	100
Retrieval Time	2.1 Maximize info retrieval speed	0.15	---	---	---	---	---
Platforms with Access	2.2 Maximize multi-platform accessibility	0.01	50	50	50	100	75
Outside Entities with Access	2.3 Maximize extra-USMA visibility	0.03	20	20	20	100	95
System Downtime	3.1 Maximize system availability	0.05	U(75,90)	U(75,90)	U(75,90)	U(90,100)	U(80,100)
	3.2 Minimize maintenance requirements	0.07	U(75,90)	U(75,90)	U(75,90)	U(90,100)	U(80,100)
Required System Updates	3.3 Maximize system update effectiveness	0.22	5	5	5	U(60,85)	U(60,85)
Unauthorized Logins	3.4 Maximize information security	0.02	100	100	100	100	100
<b>Total</b>			<b>30.7</b>	<b>40.9</b>	<b>32.4</b>	<b>85.7</b>	<b>88.7</b>

Figure 7. Alternative Value Scores

Armed with a mechanism to transform disparate value measures onto the same scale, we obtained the alternatives' raw performance data via design specifications and engineering judgment. Not surprisingly, this approach necessitated the incorporation of uncertainty, and this was accomplished by establishing lower and upper bounds on the values attained by the alternatives on several value measures. These are reflected by the blue-shaded cells of Figure 7, where  $U(\text{Lower Bound}, \text{Upper Bound})$  denotes a uniform distribution was used to mathematically model uncertainty. Additionally, in the case of the value measure 2.1.1 – Average time to return queried information (i.e., Retrieval Time in Figure 7), we opted to omit scores, as retrieval speed is directly influenced by not only the system's design but also the user's hardware and supporting IT infrastructure. Finally, the value measure weights ( $w_i$ ) and scores ( $v_i(x_i)$ ) were combined using the simple additive value model ( $V(x) = \sum_{i=1}^n w_i v_i(x_i)$ ) to obtain each alternative's total value score. Given the input's inherent uncertainty, we conducted 100 Monte Carlo trials to obtain the expected total value scores seen in the bottom row of Figure 7, as well as the distributions of total value seen in Figure 8.

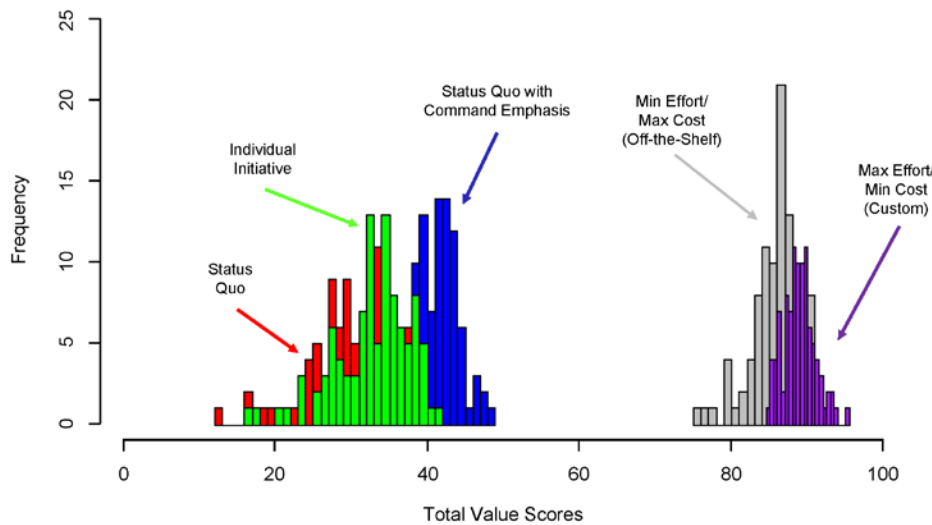


Figure 8. Total Value Score Distributions

From the distributions in Figure 8, we suspected (and subsequently confirmed) that *Status Quo with Command Emphasis* stochastically dominates *Status Quo* and *Individual Initiative*, as the majority of its most frequent scores occur at higher values. Moreover, it is obvious that *Off-the-Shelf* and *Custom* deterministically dominate the other three alternatives, and their expected total value scores are more than double the next best performing alternative, namely *Status Quo with Command Emphasis*. Finally, while *Custom* possesses the highest expected total value score (88.7), no dominance can be declared over *Off-the-Shelf*.

Given the distributions and expected total value scores, we conclude that *Off-the-Shelf* and *Custom* offer the most value and should be investigated further. Additionally, while *Status Quo with Command Emphasis* provides markedly less value than the former two alternatives, it would likely cost significantly less to implement. As such, it lies on the Pareto frontier, and it could form the basis of a far cheaper alternative. Ultimately, as a first step, we recommend that the *Status Quo with Command Emphasis* alternative be considered for near-term implementation while a more sophisticated system is investigated.

#### 4. Conclusion and Future Work

Based on the results from both the interviews and the survey, there is strong support from USMA's faculty for a centralized system to track available intellectual capital. Moreover, it is clear that USMA's faculty members are willing to leverage their expertise to assist operational commanders. Taken together, the problem statement to "develop a system to track West Point's intellectual capital in order to, ultimately, connect those who know (USMA) with those who need to know (the operational Army)" seems well-posed, and the value model and alternatives in Figures 4 and 5 are critical steps in that direction.

Looking forward, although we conjecture that procuring an off-the-shelf system would cost more than building a custom system with organic assets, actual figures need to be calculated. As such, USMA must estimate the cost to develop and field alternatives – not only in dollars but also in days – to better understand the possible trades and identify Pareto optimal solutions. Nonetheless, in the end, the decision on which system to develop (if any) rests with USMA's Dean of the Academic Board. With this in mind, as decision analysts, our job is to make her choice, and the opportunity costs implied by it, clear.

## 5. Acknowledgement

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## 6. References

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