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THESIS

ASSESSING PERFORMANCE MEASUREMENT FOR THE NAVAL SURFACE WARFARE CENTER, PORT HUENEME DIVISION

by

Thomas J. Dickinson

December 2005

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Performance measurement is a growing field of study and practice within federal government. From department level agencies to unit level commands, measuring performance is critical to achieving strategic objectives within public resource constraints. Performance metrics enable federal managers entrusted with the nation's resources to make productive decisions towards operational effectiveness and economic efficiency. This thesis assesses the performance measurement system of a singular organization: Naval Surface Warfare Center, Port Hueneme Division (PHD). This assessment addresses the appropriateness and quality of existing metrics at PHD based on academic research, while also comparing performance measurement at PHD with federal guidance. Performance drivers were captured during interviews with senior managers in offices and departments at PHD. These interviews were used to gain visibility into PHD's "story of success" in terms of critical inputs, processes, and outcomes. Causal performance maps were utilized to visually depict the interaction among these performance drivers and determine common critical performance variables (CPV) across PHD. Once determined, common CPV's were analyzed and existing metrics were assessed within balance scorecard perspectives. This analysis and assessment provided a framework for comparison between PHD and the performance measurement guidance within the federal chain of command. The assessment of existing metrics and recommendations will hopefully be useful to NSWC PHD in continuing progress toward achieving strategic success. It is also hoped that this thesis will provide a common framework for performance analysis to other Naval Surface Warfare Center commands.

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Performance measurement is a growing field of study and practice within federal government. From department level agencies to unit level commands, measuring performance is critical to achieving strategic objectives within public resource constraints. Performance metrics enable federal managers entrusted with the nation's resources to make productive decisions towards operational effectiveness and economic efficiency. This thesis assesses the performance measurement system of a singular organization: Naval Surface Warfare Center, Port Hueneme Division (PHD). This assessment addresses the appropriateness and quality of existing metrics at PHD based on academic research, while also comparing performance measurement at PHD with federal guidance. Performance drivers were captured during interviews with senior managers in offices and departments at PHD. These interviews were used to gain visibility into PHD's "story of success" in terms of critical inputs, processes, and outcomes. Causal performance maps were utilized to visually depict the interaction among these performance drivers and determine common critical performance variables (CPV) across PHD. Once determined, common CPV's were analyzed and existing metrics were assessed within balance scorecard perspectives. This analysis and assessment provided a framework for comparison between PHD and the performance measurement guidance within the federal chain of command. The assessment of existing metrics and recommendations will hopefully be useful to NSWC PHD in continuing progress toward achieving strategic success. It is also hoped that this thesis will provide a common framework for performance analysis to other Naval Surface Warfare Center commands.

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I. INTRODUCTION

A. BACKGROUND

Performance measurement is a critical function within federal agencies, now more than ever. The federal government currently spends over $2 trillion on approximately 1,000 federal programs, and the American people are entitled to know what they are getting for their money (Office of Management and Budget (OMB) 2004). The passage of the Government Performance and Results Act (GPRA) of 1993 set the stage for sweeping changes in federal business practices, requiring strategic planning and performance measurement within all federal agencies and programs. The current administration under President Bush is dedicated to improving compliance with the GPRA. This commitment is becoming pervasive within the Department of the Navy, permeating down to the unit command level.

This study focuses on one such unit within the Naval Sea Systems Command (NAVSEA). The Naval Surface Warfare Center, Port Hueneme Division (PHD) is involved in the acquisition and in-service support of Navy surface warfare systems. The command was established in 1962 by the Chief of Naval Operations, Admiral Arleigh Burke to "oversee the testing, installation, and support of surface missile systems to assure their operability." For almost 30 years Port Hueneme operated as an individual Naval engineering facility. The Base Relocation and Closure Act (BRAC) of 1991 established the Naval Surface Warfare Center (NSWC) to consolidate naval weapons and engineering activities under a parent command (NSWC 2005). Port Hueneme then became one of six divisions within NSWC, with activities strategically located in five geographic areas.

The current mission of PHD is "to integrate, test, evaluate, and provide life-cycle engineering and logistics for today's and tomorrow's surface warfare systems (NSWC PHD 2005)." PHD's work on surface ships ranges from existing Aegis ships and carriers, to new production platforms such as DD(X) and the Littoral Combat Ship (LCS). The desired outcomes at PHD are combat and weapons systems that are safe, effective, and affordable for the fleet. Functioning in this role, PHD serves as the link

between the acquisition community and the operational fleet for weapon system integration, technical authority, and engineering logistics solutions (NSWC PHD 2005). These focus areas require a knowledge-based organization that is heavily involved in the operations and sustainment (O&S) phase of the acquisition cycle.

PHD's organization is comprised of four offices and five departments as illustrated in Figure 1. The Air Dominance, Ship Defense & Expeditionary Warfare, and Land Attack Departments are located in Port Hueneme, CA. The Gun Systems Department is located in Louisville, KY, and the Land & Sea Test Department is located at White Sands, NM.

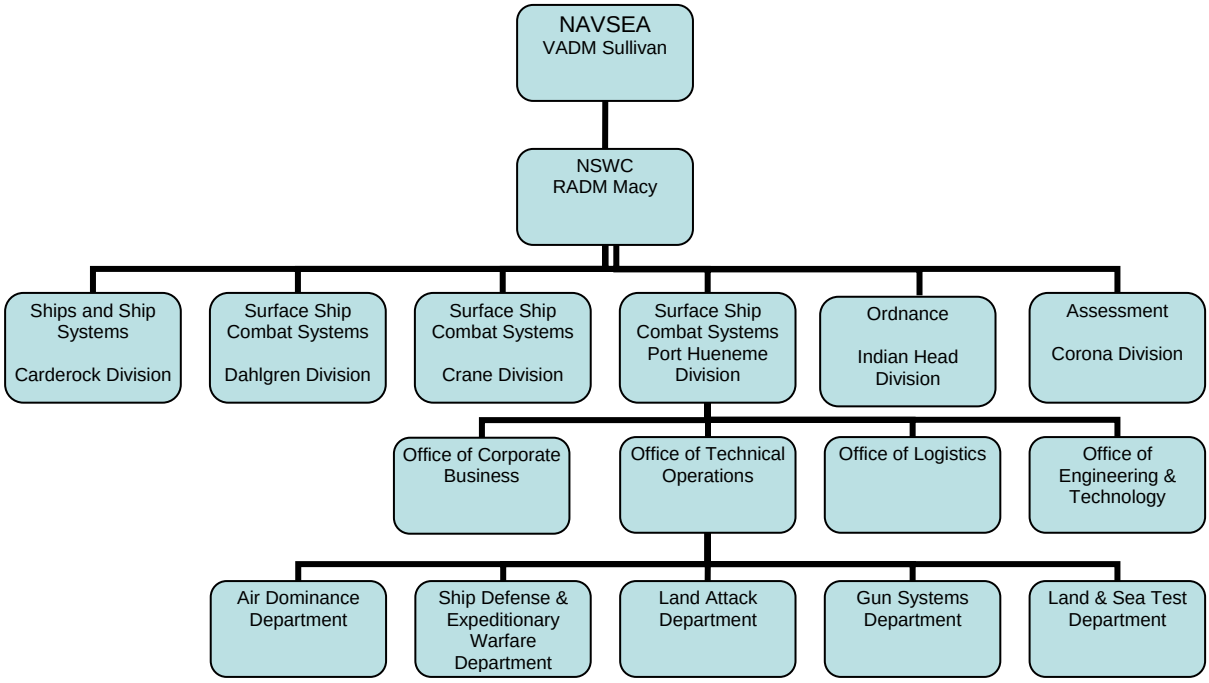

Figure 1. NSWC PHD Organizational Chart (NSWC PHD 2005)

The five departments provide the majority of services funded by program sponsors, while the four offices serve in a supporting role of the PHD enterprise. PHD has the "lead" for all installation, testing, and support of surface warfare systems in the Navy, while playing a supporting role in the concept, design, build, fix, and decommission (disposal) stages of the acquisition life cycle. As a knowledge-based organization, the only physical products produced by PHD are predominantly information-based, such as technical manuals, maintenance procedures, or test plans.

The greater part of its contribution to the Navy is in services provided to enhance the effectiveness of warfare systems in the hands of the end-user. (NSWC PHD 2005)

As a Navy Working Capital Fund (NWCF), PHD receives 63 percent of their funded workload from Program Executive Officer (PEO) Integrated Warfare Systems (IWS), and 15 percent from PEO Ships. The remainder of their funding comes from NAVSEA, the Naval Air Systems Command, and PEO Carriers, with eight percent originating from various other organizations. Due to the nature of the technically-oriented work PHD performs, a great emphasis is placed on the visionary aspects of innovation and process development. This effort must also be balanced with affordability. The four offices of Engineering and Technology, Logistics, Corporate Business, and Technical Operations support the PHD enterprise by ensuring there is a balance between a visionary and day-to-day focus in the planning and execution of work at PHD. While the offices function in a supporting role, their leadership in that role is critical to the successful execution of PHD's mission. (NSWC PHD 2005)

With a business base of approximately $600 million per year, the span of control at PHD necessitates performance measurement. With sound performance measurement and management control, NSWC PHD can answer three critical questions:

- Are we focused on core competencies?
- Are we performing well in those core competencies?
- Are we linking our performance metrics with strategy?

B. OBJECTIVE

The purpose of this thesis is twofold. The first objective is to assess the appropriateness and quality of the existing performance measurement system at PHD based on an academic literature review. The second objective is to assess performance measurement at PHD in a comparative framework with OMB, the Office of the Secretary of Defense (OSD), the Office of the Secretary of the Navy (SECNAV), and the chain of command above PHD. The intended products are recommendations for improved I moved a line of text to the next page for more text at top of page

alignment and operational effectiveness of performance measurement at PHD. Each office at PHD was studied, and after analysis of collected data, assessments and recommendations are suggested.

C. RESEARCH QUESTIONS

The primary research questions studied were:

- Research Question 1**:** Are the performance metrics currently in place adequate for PHD to achieve its strategic objectives?
- Research Question 2**:** Is the performance measurement system at PHD aligned with OMB, OSD, and SECNAV guidance?

In addition, several secondary questions are addressed including:

- What are the command mission, strategy, goals, and "story of success" at PHD?
- What are the existing performance metrics at PHD?
- What are the critical performance variables at PHD?
- How is performance measurement used at PHD?

D. SCOPE AND LIMITATIONS

1. PHD

This thesis is limited to an overall assessment of performance measurement at PHD. While recommendations at the tactical level are discussed, the intended scope is to provide an overarching evaluation. It is possible that the results of this thesis will have applications to other Warfare Centers (WC) within NSWC. However, recommendations are limited to improving the existing performance measurement system at PHD.

2. Alignment and Metrics

In terms of alignment, this thesis is limited to an overarching evaluation of the linkage between PHD and OMB, OSD, and SECNAV performance measurement execution. Metrics are limited to those appropriate for supporting the strategy of PHD.

3. Perspective

This thesis is written from the perspective that its primary users will be the senior managers of PHD.

4. Limitations

This is the author's first exposure to a Navy Working Capital Fund (NWCF) activity and a knowledge-based organization. The learning process that accompanied research may be evident at different points in this thesis.

E. METHODOLOGY

This thesis attempts to assess performance measurement at PHD by establishing a foundation of academic research in the subject area, and then applying this knowledge to data gathered in personal interviews with senior and middle management.

1. Tacit Knowledge

PHD is a knowledge-based organization that is technically focused. The strategy of this organization is ever-evolving and forward-looking. The best source of strategic and operational information in an organization such as this comes from the tacit knowledge of experienced managers within the ranks. Tacit knowledge is not easily accessible because it is deeply ingrained in the minds of organizational members. Tacit knowledge can be articulated by organizational members if they are asked the right questions and allowed to "tell a story" or use metaphors to get their point across. (Ambrosini and Bowman 2002). Capturing this knowledge provides a solid foundation for an objective assessment of the performance measurement system.

2. Interviews

The medium used for capturing tacit knowledge was personal interviews with senior and middle management at PHD. While a formal format for the interviews was utilized as a starting point, discussions evolved to informal and candid exchanges. Support from the leadership of PHD was essential in creating a cooperative atmosphere during these interviews. It was experienced without exception.

3. Causal Performance Maps

Cognitive maps are the representation of an individual's personal knowledge (Ambrosini and Bowman 2002), and of an individual's own experience (Weick and Bougon 1986), and they are ways of representing individuals' views of reality (Eden et al. 1981). Causal maps are a type of cognitive map that reflect what is understood to be happening in an organization (Ambrosini and Bowman 2002). The ability of the causal

performance map to visually represent employee tacit knowledge about factors critical to organizational success makes it suitable for the study of PHD's organization.

Interviews captured the tacit knowledge and interaction of performance drivers within each office or department at PHD. From these data, "causal performance maps" were created to visually illustrate the goal orientation and operational methodology within each office and department. This methodology provides the reader with a clear linkage between performance drivers and their effect on outputs.

4. Performance Measurement Assessment

After creating the causal performance maps, existing performance metrics in use at PHD are compared to observed performance driver relationships. An assessment is then made concerning the appropriateness and quality of existing metrics based on literature studied and data gathered. Following this, the performance measurement system at PHD is assessed in terms of alignment with federal guidance.

F. ORGANIZATION OF THESIS

Following this introduction, Chapter II reviews performance measurement literature. Chapter III provides a review of federal performance measurement guidance from OMB down to the Department of the Navy, including strategic objectives within PHD's chain of command. Chapter IV presents collected data from interviews with line managers at PHD, as well as causal performance maps resulting from these interviews. Chapter V analyzes critical performance variables within PHD and provides an assessment of the appropriateness and quality of existing performance at PHD. Chapter VI provides an assessment of the alignment between PHD's performance measurement system and federal guidance. Chapter VII presents conclusions.

II. LITERATURE REVIEW

A. THE NEED FOR PERFORMANCE MEASUREMENT

In general terms, any organization can be characterized as having inputs, transforming those inputs via certain processes, and achieving outputs from that transformation. The outputs, or ideally desired outcomes, are the reasons the organization exists. In order to determine how well the organization is progressing toward achievement of desired outcomes, a standard or benchmark is required against which to measure performance. In addition to this standard, a feedback channel is required to communicate throughout the organization how actual performance varies from expected performance. This variance information, and the standards used to obtain it, provides the manager with a means of controlling the transformation process and influencing desired outcomes. This process is captured in the Cybernetic Feedback Model (Figure 2).

Performance measurement through the cybernetic process is an important foundation for each and every organization. In the absence of this basic idea, managers lack a systematic method with which to evaluate performance variance, and thus have limited control over influencing outcomes.

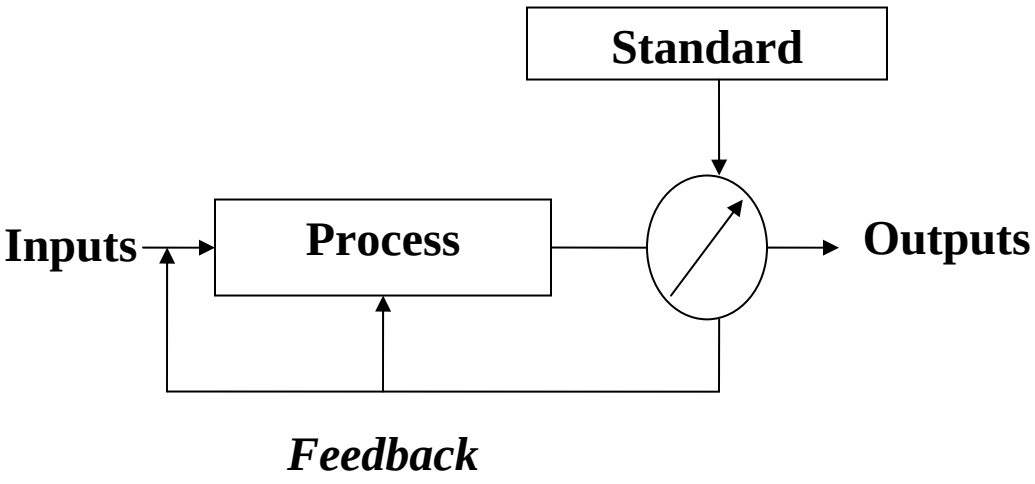

Figure 2. Cybernetic Feedback Model (From: Simons 2000)

Returning to the basic framework of inputs, processes, and outputs, it is often unclear where in the transformation process the standard should be placed for the measurement of performance. This decision process is guided by the following principles:

- Measure inputs when it is impossible to monitor processes or outputs, cost of input is high relative to value of outputs, or quality and safety are important.
- Measure processes when they can be observed or measured, cost of measuring them is low, standardization is critical for safety and quality, cause-and-effect relationships are understood, and process enhancements can result in strategic advantage.
- Measure outputs when they can be observed or measured, cost of measuring is low, cause-and-effect relationships are not well understood, and freedom to innovate is desired. (Simons 2000)

B. PERFORMANCE MEASUREMENT IN DETAIL

1. Strategy and Performance Measurement Systems

Much research has been completed in the field of performance measurement in the past 30 years. The most reliable, valid, and common typology in this research is that control systems should be congruent with strategy (Miles and Snow 1978, Shortell and Zajac 1990, Doty, Glick and Huber 1993, Boulianne 2002). Strategies are simply assumptions and expectations about cause-and-effect relationships, transformed into a formal plan. To bring strategies to life, managers must use specific performance goals to communicate direction to subordinates (Simons 2000). These performance goals are what members of the organization are going to optimize by nature, so it is critical that they are linked with strategy. This linkage naturally encourages a strategic focus within the organization, as success depends on supporting strategic objectives. This leads to the criticality of understanding what factors make the strategy succeed, and how to create a system of measurement around those central factors.

2. Selecting Performance Measures

For any chosen strategy, performance drivers are variables that either influence the probability of successfully implementing the strategy (an effectiveness criterion) or provide the largest potential for marginal gain over time (an efficiency criterion). Critical performance variables (CPV's) are the specific performance drivers that determine whether an organization succeeds or fails to achieve strategic goals (Simons 2000). CPV's should be causally linked and mutually reinforcing (Kaplan and Norton 1996). If a CPV is not considered when designing the performance measurement system, it is highly probably that the organization will fail to achieve one or a number of desired outcomes in the near future. The risk of this failure makes the process of identifying CPV's the most critical piece in designing a successful performance measurement system. If the wrong metrics are selected to capture CPV's, attention and energy within the organization will be focused on measuring data of lesser consequence.

In addition to capturing CPV's, performance metrics must meet certain criteria to be meaningful. Ideally, measures should be objective, complete, and responsive (Simons 2000).

- Objective measures are specific, can be independently measured, verified for accuracy, and trusted. Subjectivity encourages subordinates to expend energy trying to manage impressions instead of results, which raises the potential of personal bias, unfairness, and a lack of trust in the organization (Manzoni 2002).

- Complete measures capture all major aspects that are relevant to achieving a target or goal. An incomplete measure encourages the dedication of energy to unintended activities, creating a vulnerability to dysfunctional behavior.

- Responsive measures are within management's span of control, encouraging timely and actionable feedback. Unresponsive measures limit the influence of management on desired outcomes.

While it is difficult to obtain all three of these attributes within a performance measure, that should always be the goal. If not possible, managers should at least understand the impact of how a deficiency in a selected performance measure will impact employee behavior.

3. Balance Among Performance Measures

Kaplan and Norton (1992) identify the need for a balance of perspectives within a performance measurement system. The development of the balanced scorecard was driven by the insight that financial performance indicators are "lagging" and not sufficient to keep an organization on track in a rapidly changing environment. "Leading" indicators, as reflected in non-financial performance measures, are also necessary for an organization to achieve strategic objectives within this environment. (Kaplan and Norton 1992) Leading indicators are forward-looking, providing visibility into future performance that lagging indicators cannot provide.

As shown in Figure 3, the balanced scorecard suggests that organizations should look at four distinctive perspectives using both lagging and leading indicators to comprehensively develop metrics, collect data, and analyze results. By focusing on CPV's within this balanced framework, a "story of success" for the organization becomes apparent.

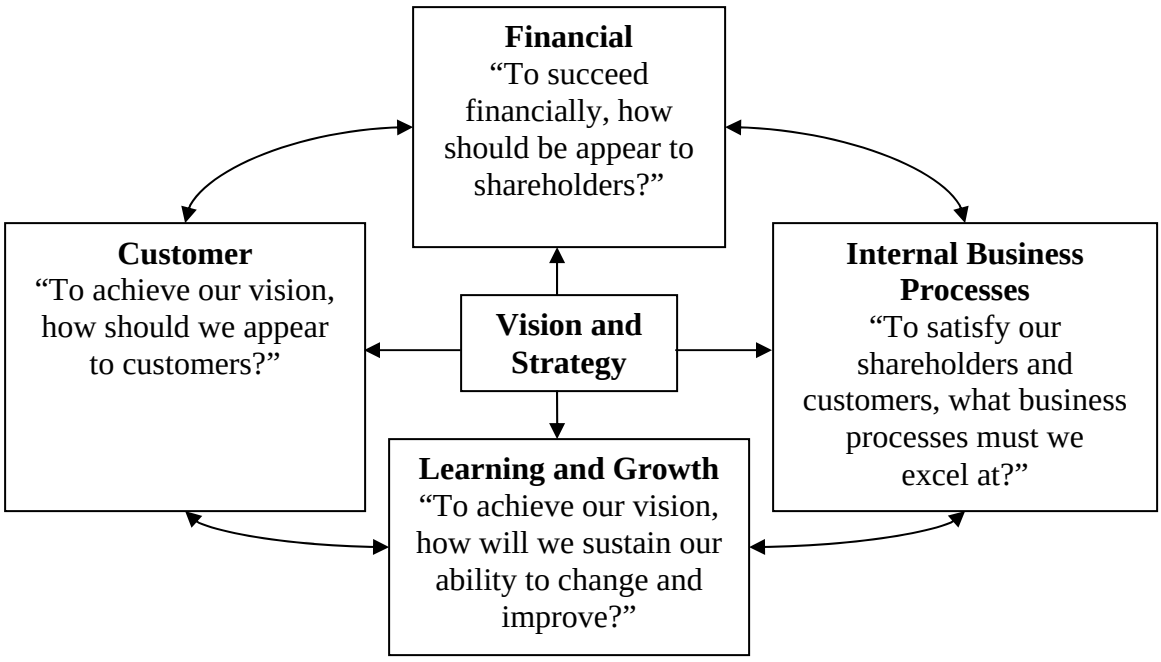

Figure 3. Balance Scorecard Model (Kaplan and Norton 1992)

4. Using Performance Measures

Organizations use performance measurement systems to track progress in activities critical to strategic success. Managers can use a performance measurement system in either a diagnostic or interactive fashion. Using a system diagnostically allows managers to monitor organizational outcomes and correct deviations from preset standards of performance (Simons 2000). This is the classic top-down approach where managers establish pre-conditions for the organization and "manage by exception," only interceding when actual performance varies from expectations. The diagnostic approach is more suitable for transformation processes that are stable in nature.

A performance measurement system can be used interactively when high levels of strategic uncertainty are present. Strategic uncertainty forces managers to actively participate in the transformation process. When managers involve themselves regularly and personally in the decision activities of subordinates, the entire organization should be focused on strategic uncertainty, disruptive changes, and opportunities (Simons 2000).

This is quite different and more challenging than the management by exception approach, but also more realistic when the organization has a volatile transformation process or environment.

Managers can use both diagnostic and interactive approaches within the organization's performance measurement system, matching each to appropriate transformation processes. This minimizes the amount of management energy dedicated to activities that can be handled at a lower level, while also ensuring that risk is mitigated in areas of high uncertainty.

5. Pervasiveness in Performance Measurement

The technical difficulties of developing, implementing, and using performance measurement systems are much easier to address than the organizational dynamics their introduction triggers (Manzoni 2002). If users of performance measurement systems do not recognize a benefit from the system, there is less incentive to dedicate time to using it effectively. Research indicates that managers reject performance measurement systems when they perceive measures to be inaccurate or subjective, targets to be arbitrary, and when communication is "top-down" only (Malina and Selto 2001). On the other hand, employees that use a performance measurement system with metrics that are objective, complete, responsive, and provide value in their work environment are likely to accept and embrace transformation (Simons 2000). For performance measurement to be pervasive throughout the organization, there must be alignment among strategy, organizational beliefs, and the performance measurement system. This alignment encourages users to commit themselves to performance measurement.

III. FEDERAL GUIDANCE REVIEW

In this chapter, the intent of the author is to provide a federal perspective on performance measurement from Congress down through the Department of the Navy. In order to bridge the gap between the department level and PHD, the author also includes a visual display of strategic objectives within PHD's chain of command. This chapter establishes the framework for the alignment assessment performed in Chapter VI.

A. FEDERAL PERFORMANCE MEASUREMENT HISTORY AND POLICY

1. Government Performance and Results Act of 1993 (GPRA)

Congress passed the GPRA in January 1993 for the following stated purposes:

> (1) improve the confidence of the American people in the capability of the Federal Government, by systematically holding Federal agencies accountable for achieving program results;
>
> (2) initiate program performance reform with a series of pilot project setting program goals, measuring program performance against those goals, and reporting publicly on their progress;
>
> (3) improve Federal program effectiveness and public accountability by promoting a new focus on results, service quality, and customer satisfaction;
>
> (4) help Federal managers improve service delivery, by requiring that they plan for meeting program objectives and by providing them with information about program results and service quality;
>
> (5) improve congressional decision-making by providing more objective information on achieving statutory objectives, and on the relative effectiveness and efficiency of Federal programs and spending; and
>
> (6) improve internal management of the Federal Government.

As stated by the Government Accountability Office (GAO), the GPRA "seeks to shift the focus of government decision-making and accountability away from a preoccupation with the activities that are undertaken - such as grants dispensed or inspections made - to a focus on the results of those activities, such as real gains in employability, safety, responsiveness, or program quality." The GPRA was intended to create a more effective, efficient, transparent, and accountable budget process that would force federal agencies to measure real outputs and outcomes in conjunction with strategic planning. The GPRA

also incorporated a reporting process to track the progress of strategic planning and performance measurement within federal programs. More than a decade later progress lags expectations as noted by the GAO.

2. GAO High-Risk Series

The GAO monitors progress and challenges in performance budgeting and associated initiatives within the current administration. The vehicle utilized by GAO to express areas of highest concern is an annual "high-risk list" which identifies federal programs, activities, and functions that require improvement. The Department of Defense (DOD) plays a role in over fifty percent of the 2005 high-risk areas, with the majority falling into the business transformation arena. The criticality of performance measurement is consistently emphasized as a common shortcoming within these high-risk areas, as demonstrated in the following 2005 high-risk summaries:

a. Approach to Business Transformation

GAO found that DOD is not executing a strategic, integrated business transformation plan that includes specific goals, measures, and accountability mechanisms to monitor progress.

b. Business Systems Modernization

GAO found that DOD has not defined performance metrics for evaluating the creation of a business enterprise architecture.

c. Financial Management

GAO found that DOD required financial management reform in the area of "plans and related results-oriented performance measures."

d. Supply Chain Management

GAO found that DOD is weak in areas of asset visibility, distribution capability, and inventory management. Furthermore, a lack of an integrated inventory management information system is cited as a limitation on measurement of overall effectiveness.

e. Weapons Systems Acquisition

GAO found that individual programs within DOD are challenged by inherent funding, management, and cultural factors that lead managers to develop business cases for new programs that over-promise on cost, delivery, and performance of weapons systems.

f Contract Management

GAO found that DOD personnel did not always make sound use of tools such as performance-based service contracting, and that safeguards for inappropriate waivers of requirements were lacking. (2005 GAO High-Risk Series)

These summaries indicate that DOD has many challenges in transforming the agency to comply with the performance and results focus of the GPRA. The President's Management Agenda (PMA) directs conscious effort at achieving goals which would mitigate these deficiencies, while also improving the quality of GPRA performance plans and budgets.

3. President's Management Agenda

The 2001 PMA articulates a sense of urgency for aggressive improvement in government performance. The focus of this plan is to achieve "immediate, concrete, and measurable results in the near term" in alignment with five government-wide goals. These five overarching goals are: (1) Strategic Management of Human Capital, (2) Competitive Sourcing, (3) Improved Financial Management, (4) Expanded Electronic Government, and (5) Budget and Performance Integration. These goals are not independent, but linked and mutually reinforcing within respective agencies. The President puts all government agencies to task in taking a "disciplined and focused approach to address these long-standing and substantial challenges (OMB 2001)."

In terms of human capital, the President expects agencies to determine core competencies and execute a human capital strategy that is linked to the mission, vision, core values, goals, and objectives of the organization. Agencies are also expected to strategically align recruitment, training, and incentive plans to maintain a high-performing workforce. These actions are emphasized as necessary to meet and exceed established productivity and performance goals (OMB 2001).

Competitive sourcing is mutually reinforced with the determination of core competencies. Identifying core competencies, measuring the output of resources consumed in those competencies, and providing true competition for commercial alternatives are all challenges faced by DOD. Objective comparisons of efficiencies between government and commercial work are often difficult to measure, but nonetheless necessary to optimize the allocation of scarce resources. The goal of the administration is to regularly examine commercial activities performed by government, promote competition through increased participation in OMB Circular A-76 initiatives, and objectively identify the most efficient means to accomplish tasks whether by the government or the commercial sector (OMB 2001).

Improving financial management in the government, and especially DOD, is another goal of the PMA. The President expects DOD to achieve a clean financial audit and maintain the ability to produce accurate and timely financial information. Amplifying this expectation, the PMA calls for improved financial systems to measure and affect performance immediately, while ensuring consistency to facilitate better performance measurement (OMB 2001).

The President also lists expanding electronic government as an essential goal for improving government performance, specifically for the citizen stakeholder. The President cites the Defense Finance and Accounting System (DFAS) as a success story in this area, having embraced the opportunity to work across service boundaries and consolidate functions to realize efficiencies and provide better services. The President's specific focus in this area are to reduce the expense and difficulty of doing business with the government, to cut government costs, and to make government more transparent and accountable (OMB 2001).

The final goal identified in the PMA is budget and performance integration. The President emphasizes this goal as the most critical, stating that improvements in the previous four goals will "matter little if they are not linked to results." Existing problems in this area include ill-defined performance measures within agencies, failures to use performance information for program management, failures to integrate performance measures with budget submissions, and failure to measure the full cost of programs. The

President's goal is to integrate performance reviews into the budget process, rewarding programs that prove themselves while breeding competition based on full costing of resources. The desired end-state is having the ability to present the American people with a transparent budget that clearly indicates the linkage to overall objectives of the administration (OMB 2001).

The President's Management Council developed an "Executive Branch Management Scorecard" and "Program Initiatives Scorecard" to track the status and progress towards achieving the goals of the PMA (OMB 2005). These "dashboards" provide the President with information on PMA progress at the agency-level, but do not drill down to specific program effectiveness. Progress for each and every federal program is tracked by the Office of Management and Budget (OMB) using Program Performance Assessments (PPA) (OMB 2002).

4. Office of Management and Budget

OMB established PPA's to evaluate the effectiveness of budget and performance integration within federal programs. The Performance Assessment Rating Tool (PART) is the instrument within the PPA utilized for a standard performance evaluation across all agencies. The PART evaluation is a questionnaire of approximately 30 questions that proceeds through four critical areas of assessment – purpose and design, strategic planning, management, and results and accountability. Questions within the PART are tailored for each specific type of program to capture essential distinctions. The questions are designed to provide a means to aggressively inquire whether GPRA standards are met within the program, placing emphasis on outcome, output, and efficiency measures. Clear criteria are given for qualifying answers. An excerpt from the PART illustrates this:

II. STRATEGIC PLANNING

2.3 Does the program have a limited number of specific annual performance measures that can demonstrate progress toward achieving the program's long-term goals?

A yes answer must have the following elements:

(1) A limited number of discrete, quantifiable, and measurable annual performance measures have been established for the program.

(2) Annual performance measures adequately measure the program's progress toward reaching the long-term goals evaluated in Questions 2.1 and 2.2 (previous questions in the PART)

(3) Annual performance measures focus on outcomes. Measures may focus on outputs if the program can adequately justify why it is unable to define a satisfactory quantifiable outcome measure. The explanation must clearly state how the outcomes help achieve the long-term goals of the program.

(4) Programs must have at least one efficiency measure as part of their annual measures. (OMB 2002)

The PART scores each of the four areas on a numeric scale, which is then translated into an overall qualitative rating that ranges from Effective, to Moderately Effective, to Adequate, to Ineffective, to Result Not Demonstrated. The intent of the PART is to put the burden of proof for effectiveness on federal managers, while ultimately providing a baseline for results-based budget decisions.

As of 2004, over half of the programs analyzed by the PART received a rating of Results Not Demonstrated due to a lack of performance measures and/or performance data. OMB plans to review approximately one-fifth of all federal programs every year, such that by the 2008 budget submission every program will have an evaluation from the PART (OMB 2004). As of 2005, 23 DOD programs have been evaluated by the PART, with ratings broken down in Table 1. Ratings thus far are mixed, but heavily concentrated towards "Moderately Effective" and "Effective."

Results not Demonstrated	Ineffective	Adequate	Moderately Effective	Effective
3	1	3	6	10

Table 1. 2005 Department of Defense PART Ratings (OMB 2005)

The Executive Branch also has proposed legislation for further performance and results regulatory authority. The Government Reorganization and Program Performance

Improvement Act of 2005 would authorize "Results Commissions" to assess problematic agencies and programs. The results of these assessments could lead to reorganization or possibly abolishing agencies and programs that do not demonstrate results. In this vein, it is clear that OMB is actively tracking and forcing improvement within the area of performance measurement.

5. Office of the Secretary of Defense (OSD)

DOD is making constant progress towards achieving each of the five strategic goals in the PMA. Much of this progress is centered on performance measurement. OSD prescribed Management Initiative Decision (MID) 901 to better align DOD's performance management activities with the PMA and the Risk Management Framework established in the 2001 Quadrennial Defense Review (QDR). The QDR provides a long-range projection (notionally 20 years) of strategic objectives in areas of force structure, force modernization, infrastructure, and budget. The Risk Management Framework in the QDR is based on the balanced scorecard approach, but utilizing risk factors as illustrated in Figure 4.

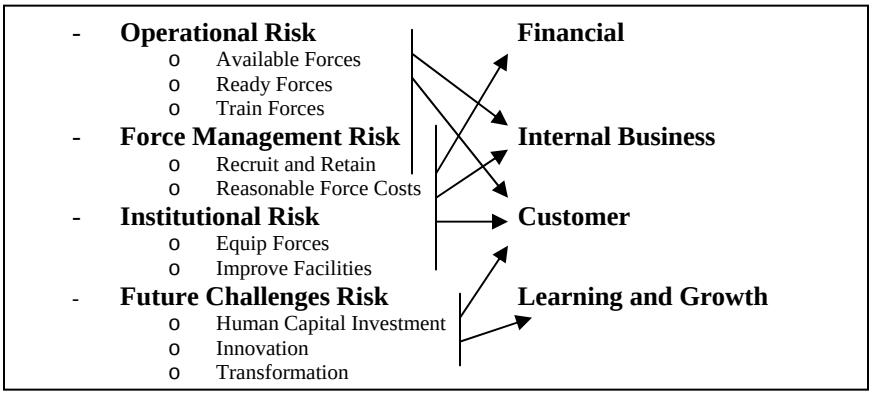

Figure 4. Alignment of DOD Risk Management Framework with Balanced Scorecard Perspectives (OSD/PA&E 2005)

The QDR is coupled with Strategic Planning Guidance (SPG), Joint Planning Guidance (JPG), and the Future Years Defense Plan (FYDP) documents to provide the

input for the balanced scorecard generation process for DOD. These inputs are translated into a performance budget using the PPBE process. The balanced scorecard format is when used to systematically evaluate the results of execution (Figure 5.)

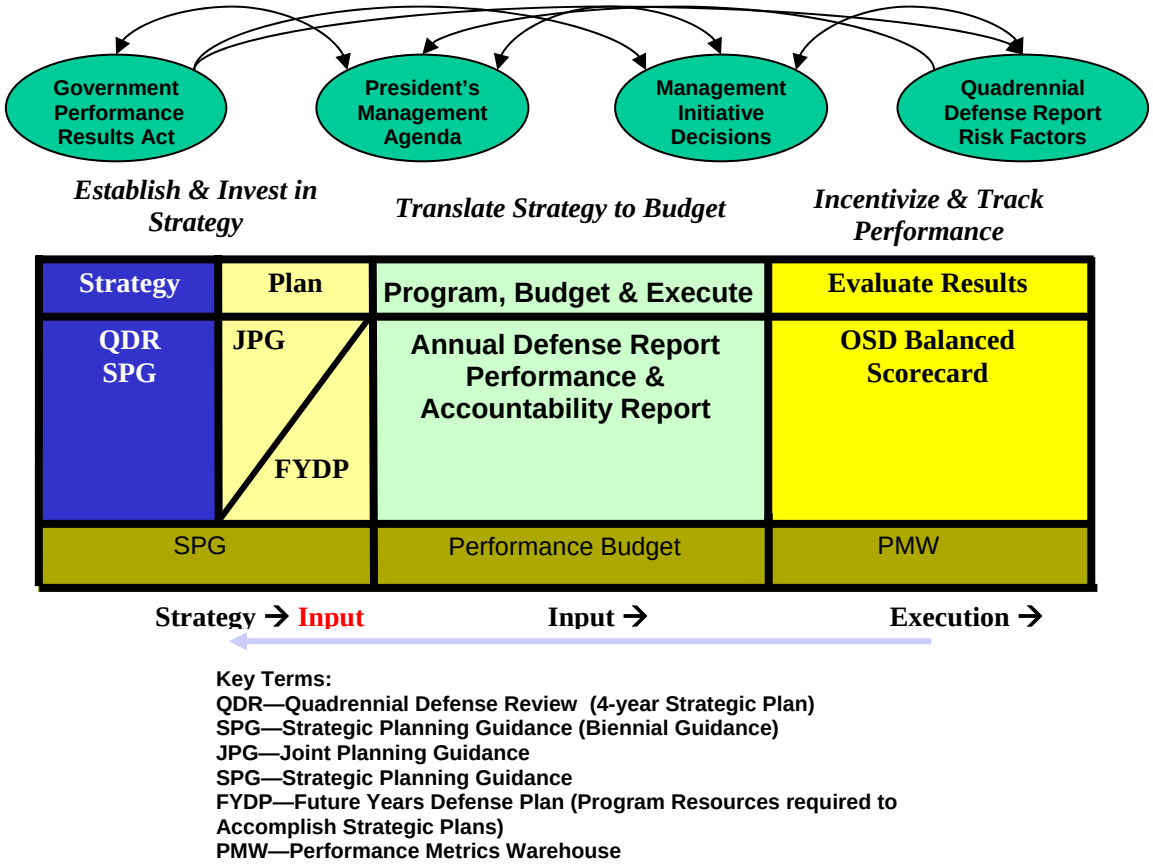

Figure 5. OSD Balanced Scorecard Process (From Assistant Secretary of the Army for Financial Management and Comptroller)

DOD defines four to five outcome goals within each risk category of the "risk area scorecard," each with associated output measures. These outputs must be tied to strategy, quantifiable, measurable over time, relevant to establish an objective level of performance, tied to specific measures in line organizations to drive behavior, and preferably linked to inputs for investment trend analysis (OSD PA&E 2005). The current balanced scorecard outcome goals for DOD are illustrated in Figure 6.

Force Management Goals	Operational Goals
-Ensure sustainable military tempo -Maintain workforce satisfaction -Shape the force of the future -Maintain quality workforce -Maintain reasonable force costs	-Successful plan/strategy execution -Critical needs, systems, people, sustainment, and infrastructure -Are forces currently ready? -Do we have the forces available?
Institutional Goals	**Future Challenges Goals**
-Streamline decision process, drive financial management, and acquisition excellence -Improve readiness and quality of key facilities -Realign support to the warfighter -Manage overhead and indirect costs	-Drive Joint Operations -Define and develop transformation capabilities -Define future human skills and competencies -Develop more effective organizations

Figure 6. DOD Risk Area Scorecard Goals (DOD 2004)

Using the framework presented in Figure 6, DOD made tangible progress towards the objectives of the PMA. In July 2005, DOD released "President's Management Agenda: Results for the Department of Defense, 2005," which details DOD's performance measurement mentality and achievements to date. Highlights follow:

a. Strategic Management of Human Capital Initiative

Effort is being expended to build a performance culture at all levels of DOD, with performance-based initiatives and incentives either planned or in place within the workforce. Examples include a pay-for-performance strategy at Senior Executive Service (SES) and senior management levels, finalizing the design of the revolutionary performance-based National Security Personnel System (NSPS) for DOD civilians, and increasing utilization of stakeholder surveys to provide timely and accurate feedback. DOD is also taking an approach of examining core competencies in the workforce to minimize competency gap risk and ensure "the right person is in the right job at the right time." Additionally, focus is also being placed on electronic government integration with NSPS, the base realignments and closure (BRAC) Priority Placement Program (PPP), and

the Workforce Planning and Restructuring initiatives to ensure human capital transformation is transparent, effective, and efficient. (OSD 2005)

b. Competitive Sourcing

DOD intends to use "competitive sourcing" whenever it makes military and economic sense to do so. In promoting competition, DOD focuses on outcome and efficiency goals, training responsible officials as enablers within the competitive sourcing program, providing timely and accurate information for decision-making, and performance-based cost comparisons. DOD is addressing a lag in new competitions within DOD in 2005 with a renewed emphasis on achieving competitive sourcing goals in accordance with the PMA. (OSD 2005)

c. Improved Financial Management

DOD's intention is to improve financial management transformation such that it better aligns with commercial practices, produces credible financial statements, and provides the ability to make more efficient and effective business decisions in support of the warfighter. Outcomes and efficiency are measured in an effort to reduce unnecessary penalties, delinquencies, reports and accounting adjustments. Common business rules have been identified to improve Military Equipment (ME) visibility, one of the shortcomings identified in the PMA. For the long term, the Business Management Modernization Program (BMMP) within DOD is focused on improving the overall performance of critical enterprise business systems programs. (OSD 2005)

d. Expanded Electronic Government

DOD's role in expanding electronic government is centered on efficiency, effectiveness, and outcome goals. DOD plays a leading role in the procurement and acquisition areas to effect implementation of the Integrated Acquisition Environment (IAE). The vision of IAE is to simplify and unify acquisition business practices within electronic government while meeting strategic and cost-effective goals for acquisition and delivery of goods and services to the warfighter. DOD developed three programs under the IAE that are now used across the government. These programs provide common business practices for contractor registry, technical data solutions, and past performance information retrieval. Other initiatives in defense travel services, training

and education transformation, and grant application have been standardized in an electronic format to realize efficiencies, increase effectiveness, and influence desired outcomes. (OSD 2005)

e. Budget and Performance Integration Initiative

DOD utilizes the Planning, Programming, Budgeting and Execution (PPBE) process to increase the effectiveness of resource allocation by linking performance results to programming and budgeting decisions and placing additional emphasis on program execution. Adjustments to resource allocation are made based on evaluations of performance data and assessments of how programs contribute to mission success. Over $30 billion in savings was realized in the FY06 President's Budget through PPBE and an emphasis on performance criteria. This is evidence that budget and performance integration is quickly becoming a standard as called for in the PMA. Furthermore, programs which execute poorly or fail to demonstrate results are in danger of losing resources to higher priority efforts within DOD. (OSD 2005)

In addition to PMA progress, DOD is embracing the PART to assess programs representing more than 60 percent of resources in the FY 2006 President's Budget. For the FY07 budget, PART assessments will be conducted on eight new programs, with four reassessments conducted on previously assessed programs (OSD 2005). This emphasis on the PART and the performance and results mentality are likely to have a trickle-down effect as each service structures programs to meet and exceed PART requirements.

6. Secretary of the Navy and Financial Management and Budget

The GPRA, PMA, PART, and DOD Risk Management Framework provide the foundation for performance measurement requirements within the Department of the Navy. The Navy appears to be committed to achieving the goals of the PMA as evidenced through the planning and execution of DOD and service-specific initiatives such as the Navy Converged Enterprise Resource Planning (C-ERP) program, the commitment to study 63,420 positions for competitive sourcing, conversion to NSPS, and a completely revamped human capital strategy (FMB 2005). The Navy has completed nine PART assessments (39 percent of total DOD assessments), while utilizing

performance metrics for eighty-six percent of requested resources in the FY 2006/FY2007 Budget (FY 2006/FY2007 Department of the Navy Budget). This budget and performance integration process resulted in identifying 17 strategic goals for the Navy within DOD's Risk Management Framework, with performance metrics tied to each strategic goal. This integration follows the intent of the GPRA and PART instrument, while covering the objectives of the PMA in a detailed manner. The Secretary of the Navy adapted this framework to include strategic enablers within the Navy as identified in the Navy's balanced scorecard (Figure 7) (FMB 2005).

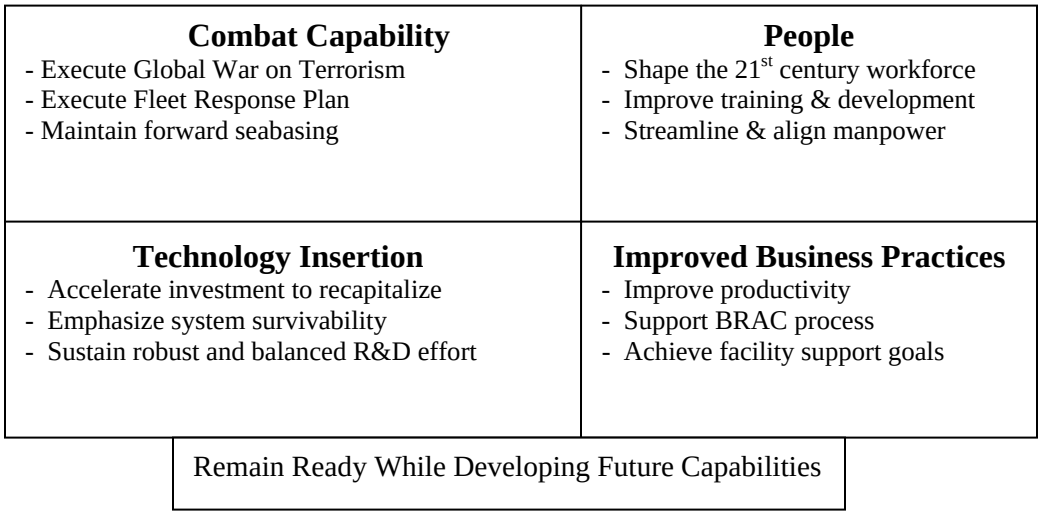

Figure 7. Navy Balanced Scorecard (FMB 2005)

The Chief of Naval Operations (CNO) also emphasizes performance measurement in his 2006 guidance. One of his ten guiding principles is "effects-based thinking," which will be applied across the Navy to "continually monitor progress against a discrete set of metrics, reallocating resources or effort as required to achieve concisely stated desired effects (CNO 2005)." The CNO's methodology for implementing this principle is to "institutionalize executive development for our senior military and civilian leadership to include formal training and career path planning (CNO 2005)." It appears that this top-down management style seeks to achieve the same effects as the GPRA, PART, and PMA. A performance and results mentality should permeate through senior leadership, drilling down to the unit level.

B. STRATEGIC OBJECTIVES

This section establishes the strategic environment within which PHD operates. The author intends to bridge the gap between the department level and PHD by discussing strategy within each office, and then providing a visual illustration of the linkage of strategic objectives within the chain of command.

As performance metrics should be linked with strategy, an appropriate starting point for analyzing performance measurement is a determination of the strategic environment for PHD. PHD reports directly to NSWC Headquarters in Washington D.C. for all formal matters. NSWC Headquarters reports directly to the Commander, Naval Sea Systems Command (NAVSEA), who subsequently reports to the Chief of Naval Operations (CNO). In turn, the CNO reports to the Secretary of the Navy (SECNAV). (NSWC PHD 2005)

1. The Secretary of the Navy

As previously stated, the Secretary aligns the Navy's overarching goals within DOD's Risk Management Framework of Force Management Risk, Operational Risk, Institutional Risk, and Future Challenges Risk. SECNAV's strategic objectives include executing the Global War on Terrorism, shaping the 21st century workforce, sustainment of a robust and balanced R&D effort, and improving productivity across the board (FMB 2005). Progress toward these objectives is made through four strategic enablers:

- People
- Combat Capability
- Technology Insertion
- Improved Business Practices

2. Chief of Naval Operations

In the CNO's guidance for 2006, he remains committed to the three priorities of sustaining combat readiness, building a fleet for the future, and developing 21st century leaders. To address these priorities, the CNO has seven strategic objectives. (CNO 2005)

- Support the joint and combined war on terror both from the sea and ashore, while staying ready to meet other operational requirements.

- Determine and deliver on the Navy's future force structure requirements by a) defining an improved force structure and construction plan and b) contributing to a stable industrial base.
- Drive to execution Sea Warrior and other ongoing manpower and personnel transformation efforts. Deliver on specific improvements that will improve the lives, careers, and leadership potential of our Sailors and our families.
- With the USMC, increase the value of contributions to the Joint Force.
- Develop closer working relationships with the U.S. Coast Guard and other governmental and non-governmental organizations to support national security policy, enhanced homeland defense, and improve maritime domain awareness.
- Apply effects-based thinking across the Navy.
- Become leaders of change and innovation. (CNO 2005)

3. Naval Sea Systems Command

The strategic objectives articulated in NAVSEA's 2005 guidance are as follows:

- Human Capital Strategy Enhancement
- Capture Cost Reduction
- Task Force Lean
- Improve and Measure Productivity
- Virtual SYSCOM (NAVSEA 2005)

4. Naval Surface Warfare Center

NSWC's 2005 Concept of Operations articulates five strategic objectives:

- Operate as a single, cost-effective enterprise
- Warfighting effectiveness
- Right Work at the Right Place
- Manage Technical Risk
- People, Process, Facility, and Systems Transformation to Sea Power 21 and Joint Vision 2020 (NSWC 2005)

5. Naval Surface Warfare Center, Port Hueneme Division

NSWC PHD identified five strategic objectives during a strategy planning session in April 2005.

- Improve Combat Systems Readiness
- Operate as a Seamless Organization by Improving Enterprise Collaboration
- Embrace New Technology and Develop a Culture of Innovation
- Develop and Reward Our Workforce (Human Capital Strategy)
- Improve the Efficiency, Delivery and Quality of Our Products…Right Work at the Right Cost (NSWC PHD 2005)

On the following page, Figure 8 cascades the objectives and goals listed above from the Secretary of the Navy down to PHD, illustrating the linkage of strategy between reporting levels. While PHD should link their performance metrics to their specific strategic objectives, it is also important to consider the alignment of PHD with strategic objectives within their immediate chain of command. An effective performance measurement system should provide feedback internally throughout PHD, and also up through the chain of command. The illustration of the linkage in strategic objectives and goals between reporting levels is made by the author based on his understanding of organizational perspectives. The author intends for this linkage to be the foundation for an assessment of PHD's performance measurement alignment with federal guidance. This assessment is conducted in Chapter VI.

STRATEGIC OBJECTIVES AND GOALS

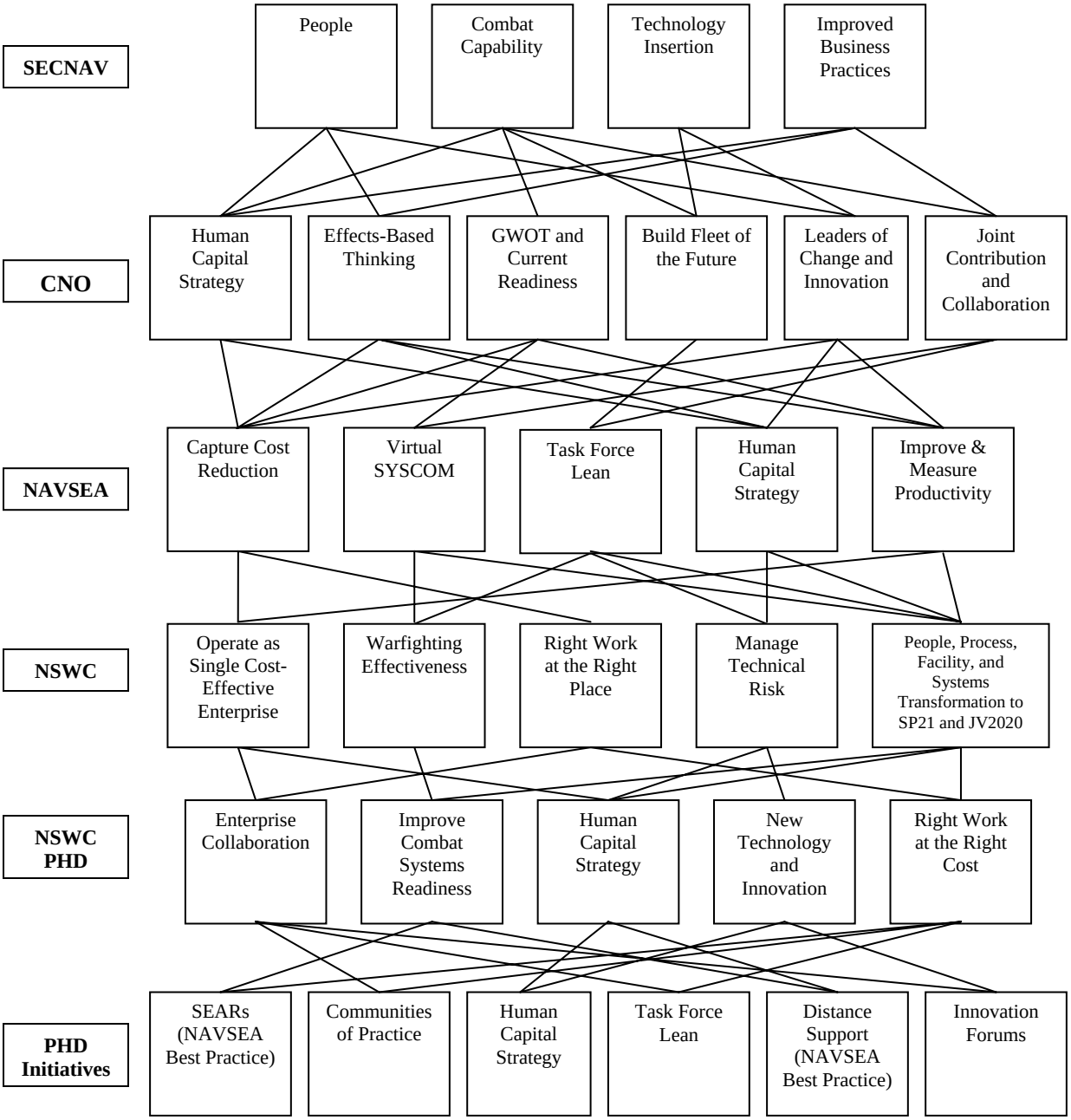

Figure 8. Alignment of Strategic Goals through NSWC PHD

IV. COLLECTED DATA

A. INTERVIEWS

Seven interviews were conducted to capture the tacit knowledge of line managers in the offices and departments at PHD. Questions during the interviews were directed to allow managers to describe how their organization operates, how success is viewed, and what performance drivers determine success or failure. Causal performance maps were created from the data collected during these interviews, from which managers were asked to provide feedback on the accuracy contained therein. The process of fine tuning the maps provides a clear look at the office or department from the perspective of each line manager.

In order to visually illustrate a comprehensive picture of the performance drivers at PHD, the individual maps were then merged into a composite map. This was accomplished by examining performance drivers for commonality, while also ensuring that important factors were not excluded for the sake of simplicity. In a forward-looking, technically-oriented, knowledge-based organization such as PHD, the interaction of performance drivers is varied and complex. The mapping provides a true representation of data collected on the determining factors of success at PHD, highlighting the complexity of the organization.

The subjects interviewed were within the Office of Corporate Business, the Office of Logistics, the Office of Engineering and Technology, the Office of Technical Operations, the Ship Defense and Expeditionary Warfare Department, and the Task Force LEAN office. Two interviews were conducted within the Office of Corporate Business to distinguish between comptroller and other business functions. The purpose of the Task Force LEAN interview was to provide a background for a critical process at PHD, and was not translated into a causal performance map. Subjects for interviews were selected based on who was likely to possess the most tacit knowledge within a specific office or department. Each interview was conducted by the author at PHD.

The interviews were semi-structured. The protocol for the interview is depicted in Table 2. Deviations from the protocol occurred frequently during the interviews when explication of organizational issues was required. The interviews provided the data to identify the inputs and processes that have an effect on the outcomes critical to success. These cause-and-effect relationships were transformed into the causal performance maps.

B. CAUSAL PERFORMANCE MAPS

Figures 9 through 14 illustrate individual causal performance maps created for the offices and departments at PHD. A description of and relevant information follow each map. Interview subjects are identified as Subjects A through F for the purpose of anonymity. The maps organize inputs on the left, processes in the center, and desired outcomes on the right. The arrows and double-headed arrows indicate the linkage of inputs and processes to desired outcomes. The author utilizes common terms across maps if doing so does not diminish the information presented by the subjects interviewed.

Figure 15 illustrates a composite causal performance map created by consolidating individual maps from the offices and departments at PHD. This composite map sets the foundation for creating performance metrics, as it identifies the critical performance variables across the organization.

1. Record time, place, and identity of interviewee.

2. Indicate that the interviewee will remain anonymous and record consent to being recorded for the purpose of this performance measurement project.

3. Could you describe your role and responsibilities in your current position?

4. What would you say are the overarching goals of your office?

5. Ideally, what would be the desired performance outcomes for your office in support of PHD's strategic objectives?

6. If you could describe how your office could achieve those desired outcomes, how would you describe that scenario?

7. What factors are critical in determining whether you successfully meet your goals and optimize the performance of your office? Possible follow-up examples include:

   A. Financial efficiency (Achieving NOR and other financial targets)

   B. Maintaining a strong business base (Communication/innovation)

   C. Investments in the workforce (hiring/attrition plan, training, incentives/rewards, human capital strategy)

   D. Investments in infrastructure and technology

   E. Collaboration with other entities (other WCs and product areas)

   F. Competitive sourcing of contract work (Quality)

8. Are the factors you mentioned linked in any way?

9. Do you measure these factors? Are any of these factors difficult to measure?

10. If any factors are not being measured, would measurement help your office achieve success?

11. In your opinion, does the workforce at PHD use the measures currently in place?

12. Looking into the future 5 years, are there any factors you did not mention that will eventually be critical to PHD's success?

13. Who are the customers that you serve, both internal and external to the organization?

14. How do you measure customer satisfaction?

15. What is the biggest indicator of failure for PHD?

Table 2. Interview Protocol

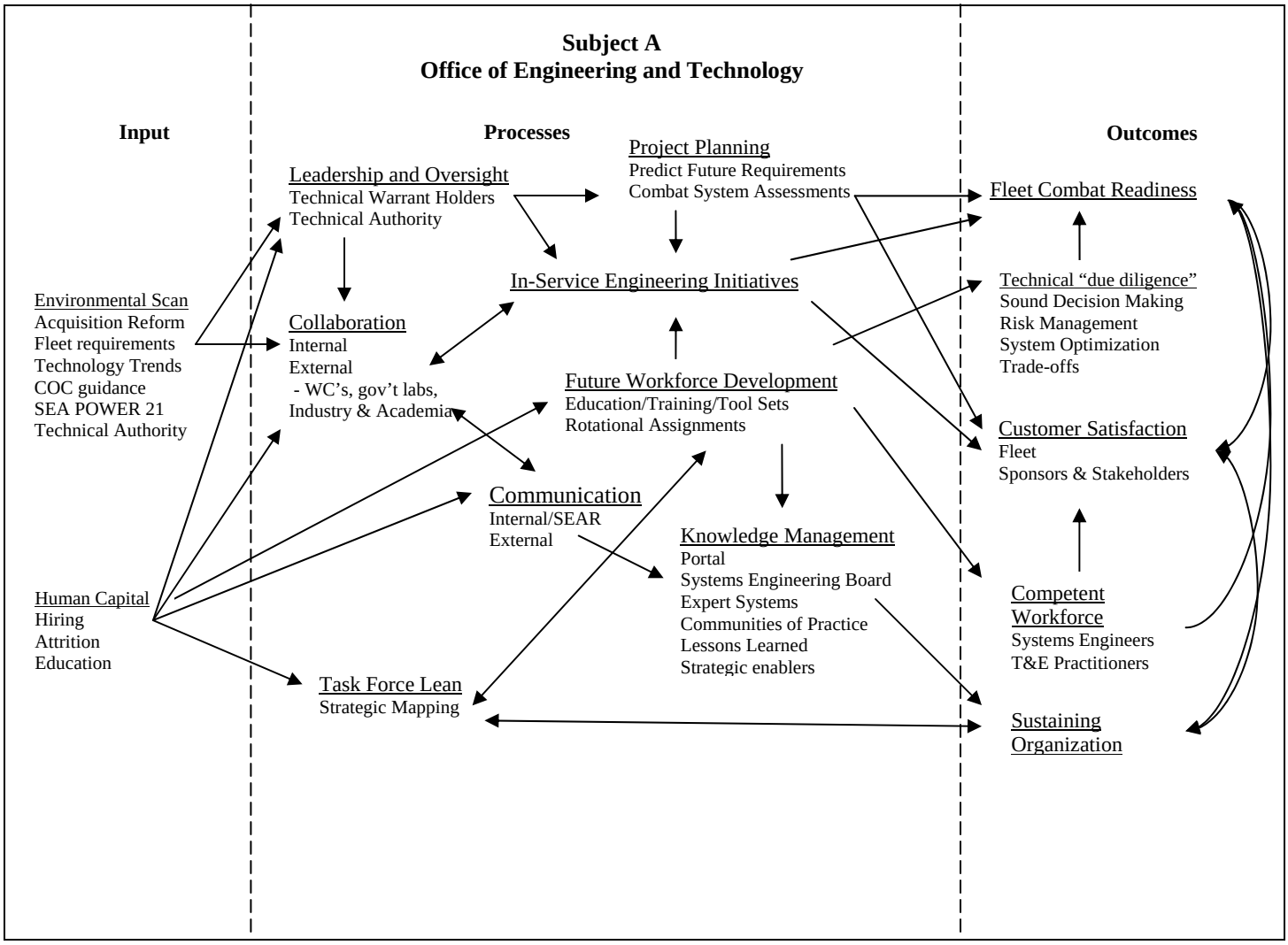

Figure 9. Causal Performance Map – Subject A

1. Engineering and Technology

a. Outcomes

Subject A indicated that the focus for the Office of Engineering and Technology (E&T) should be 75 percent visionary and 25 percent on day-to-day operations. This is due to the forward-looking leadership he must provide to remain on the cutting-edge of technology for the surface fleet. Subject A stressed that the primary goal, or outcome, of his office is to facilitate higher fleet combat readiness. He indicated that this is accomplished through effective process management that is discussed below, and also through two other desired outcomes: a competent workforce and practicing

"due diligence" in the execution of technical responsibilities. It was made clear to the author that a competent workforce is the backbone of the innovation culture at PHD, formed around a core of systems engineers and test and evaluation (T&E) practitioners. PHD has 10 resident technical warrant holders, who are subject matter experts formally recognized as such by NAVSEA (NAVSEA 2003). As subject matter experts, it is essential for these technical warrant holders to exercise "due diligence" through sound decision making, risk and value assessment, system optimization, and understanding the trade-offs within a situational context.

Customer satisfaction is another desired outcome that characterized success for Subject A. Customers for Subject A are defined as primarily the fleet, but also include funding sponsors such as PEO IWS and PEO Ships. Subject A indicated that customer satisfaction is quite different between the two stakeholders. For the fleet customer, satisfaction is reinforced by the outcome of higher fleet combat readiness. For funding sponsors, customer satisfaction is also typified by higher readiness, but additionally by the ability of PHD to be a sustaining organization that can respond to current and future challenges in an effective and efficient manner.

Subject A indicated that a long-term desired outcome for his office is to facilitate PHD as a sustaining organization. A sustaining organization gains leverage from the knowledge embedded in the workforce, coupled with effective and efficient process management, and continually provides value-added service and products to the fleet. Subject A indicated that E&T must always look forward and find ways to improve processes if they are to facilitate PHD as a sustaining organization.

b. Processes

Consistent with every subject interviewed within the offices and departments at PHD, Subject A indicated that communication, collaboration, workforce development, and Task Force Lean are each critical processes in attaining desired outcomes. He indicated that above and beyond these factors, the processes of leadership and oversight, developing in-service engineering initiatives, project planning, and

knowledge management are critical processes within his office. Within these processes, knowledge management and future workforce development were specifically highlighted as essential for success.

Subject A also indicated that internal and external communication is a key process within E&T. Internally, E&T communicates with every office and department to understand and influence planning and execution efforts. Externally, communications with other Warfare Centers (WC) is essential in facilitating collaboration while maintaining an accurate picture of the overall NSWC enterprise. Additionally, maintaining an interface with outside organizations such as program offices, fleet commands, and type commanders was stressed as essential to recognizing emerging trends and requirements, while also receiving feedback from the front line.

Collaboration, facilitated by communication, is an especially critical process for PHD. Subject A indicated that E&T functions as an integrator to realize synergies between and across departments at PHD. He indicated that these synergies are the entering argument to developing in-service engineering initiatives, which directly influence fleet combat readiness. External collaboration was also cited as critical. E&T collaborates with other WC's, and also with government laboratories, industry, and academia to stay on the leading edge of technology.

Subject A indicated that developing and implementing in-service engineering initiatives is the core process that E&T performs, directly influencing fleet combat readiness and customer satisfaction outcomes by providing value-added services. Subject A commented on PHD's innovation of the "Distance Support" system, recognized as a "best business practice" by NAVSEA. Distance Support is a system where PHD engineers are able to provide direct technical services to the fleet via "low-touch" information technology. This frees up capacity for PHD engineers to perform more work at PHD, instead of "high-touch" assist visits to ships (NSWC PHD 2005). However, Subject A inferred that creating and implementing these initiatives is anything but simple. An example that Subject A presented was a potential technological change from live-fire testing of a certain weapon system to computer modeling for validation criteria. In order to successfully plan and execute the initiative, a workforce trained and

accustomed to live-fire methodologies must be provided the tool sets and training necessary to succeed in a modeling environment. Subject A indicated that collaboration between offices and line managers within the departments is essential in adapting to new processes, such as in this example. These comments highlight the significant impact that the future workforce development process and collaboration process have on in-service engineering initiatives developed within E&T.

Subject A indicated that future workforce development is a critical process within E&T due to an increasing span of attention in an environment of accelerated technological change. Subject A stated that the single indicator of failure in his office would be complacency or the inability to adapt to change. He indicated that rotational assignments within departments are an essential component of ensuring change is embraced at PHD. These assignments breed cross-functional expertise in the workforce, leading to "communities of practice" where knowledge is optimized across departments. Subject A also made it clear that E&T must provide the education, training, guidance, and tool sets to the workforce if they are to execute technical warrant holder duties satisfactorily. This includes education in Task Force Lean, which is discussed below.

Subject A also indicated that E&T relies heavily on early and accurate planning. The planning process is critical in predicting and meeting future requirements for the surface fleet. E&T analyzes from a systems perspective how best to direct energy and efforts toward future needs, which directly results in projects that enhance fleet combat readiness (NSWC PHD 2005). Other than the systems approach within the lifelines at PHD, another avenue by which E&T captures trends and fleet needs is the Combat System Assessment (CSA). During a CSA, a Navy ship will moor at Port Hueneme and will receive a comprehensive assessment, or "groom," of her combat systems suite. This provides PHD engineers with the opportunity to target specific areas of concern, while receiving face-to-face feedback from fleet technicians. Engineers assess everything from configuration control, to spare parts management, to maintenance procedures in order to obtain a comprehensive picture of system effectiveness (NSWC PHD 2005). This hands-on expertise not only provides valuable feedback, but also sets the planning stage for further innovations to enhance readiness.

Subject A alluded to the criticality of leadership and oversight within E&T. He stated that E&T has the responsibility of "shepherding" technical warrant holders; ensuring technical authority held by NAVSEA is sufficiently supported. He stated that E&T also provides the leadership for safe, effective, and affordable processes at PHD. The Safety, Effectiveness, Affordability, and Reliability (SEAR) program at PHD is led by E&T, as their primary function is to integrate standards across the command (NSWC PHD 2005). This indicated to the author that leadership and oversight contributes to collaboration, project planning, and the development of in-service engineering initiatives within E&T.

Knowledge management is a process viewed as a strategic enabler by Subject A. Centralizing knowledge via the PHD information technology portal, using the Systems Engineering Board to standardize processes, using expert systems to streamline processes, developing communities of practice, and applying lessons learned were all cited as elements of a successful knowledge management process at PHD. The ability to organize and learn from an immense bank of knowledge should directly support the outcome of a "sustaining organization" at PHD.

Consistent with all other interviews, Subject A indicated that a "Lean mentality" must be pervasive across the command to truly improve processes, and support PHD as a sustaining organization. NAVSEA implemented the "Lean" methodology across all subordinate commands in August 2004. "Lean events" map out inefficient processes in great detail, with the goal of realizing cost savings through a more efficient allocation of resources in that process (e.g., time, people, effort). At PHD, processes to be "Lean-ed" are identified strategically by senior managers, with focus placed on the best prospects for cost savings (NSWC PHD 2005). In order to execute these events, the workforce must be trained to understand and have the ability to apply the methodology (NSWC PHD 2005).

c. Inputs

Each subject interviewed indicated that human capital is an input to the processes in their office or department. Subject A indicated that within E&T human capital is viewed as a civilian and military partnership. While the majority of the

workforce is civilian, he indicated that the military component provides E&T with a pulse from the fleet. This should result in a more balanced current and future perspective for the work within E&T. Subject A also indicated that a role of E&T is to guide line managers in hiring decisions. Turnover of experienced workers has increased due to end-strength policies, but Subject A views this as both an opportunity and a threat. While losing a worker with 20 to 30 years of experience will result in "brain drain" in the organization, it also allows E&T, through hiring decisions, to better align the work force with new technologies (NSWC PHD 2005).

Subject A indicated that another relevant input for work within E&T is an "environmental scan." He indicated that it is critical to keep abreast of acquisition reform, changing fleet requirements, and technology trends. Additionally, guidance from the chain of command and the Navy's Sea Power 21 were stressed as important in terms of direction provided and a framework within E&T to work. Subject A also indicated that understanding the technical authority environment is key to successfully executing due diligence in performance of technical warrant holder duties.

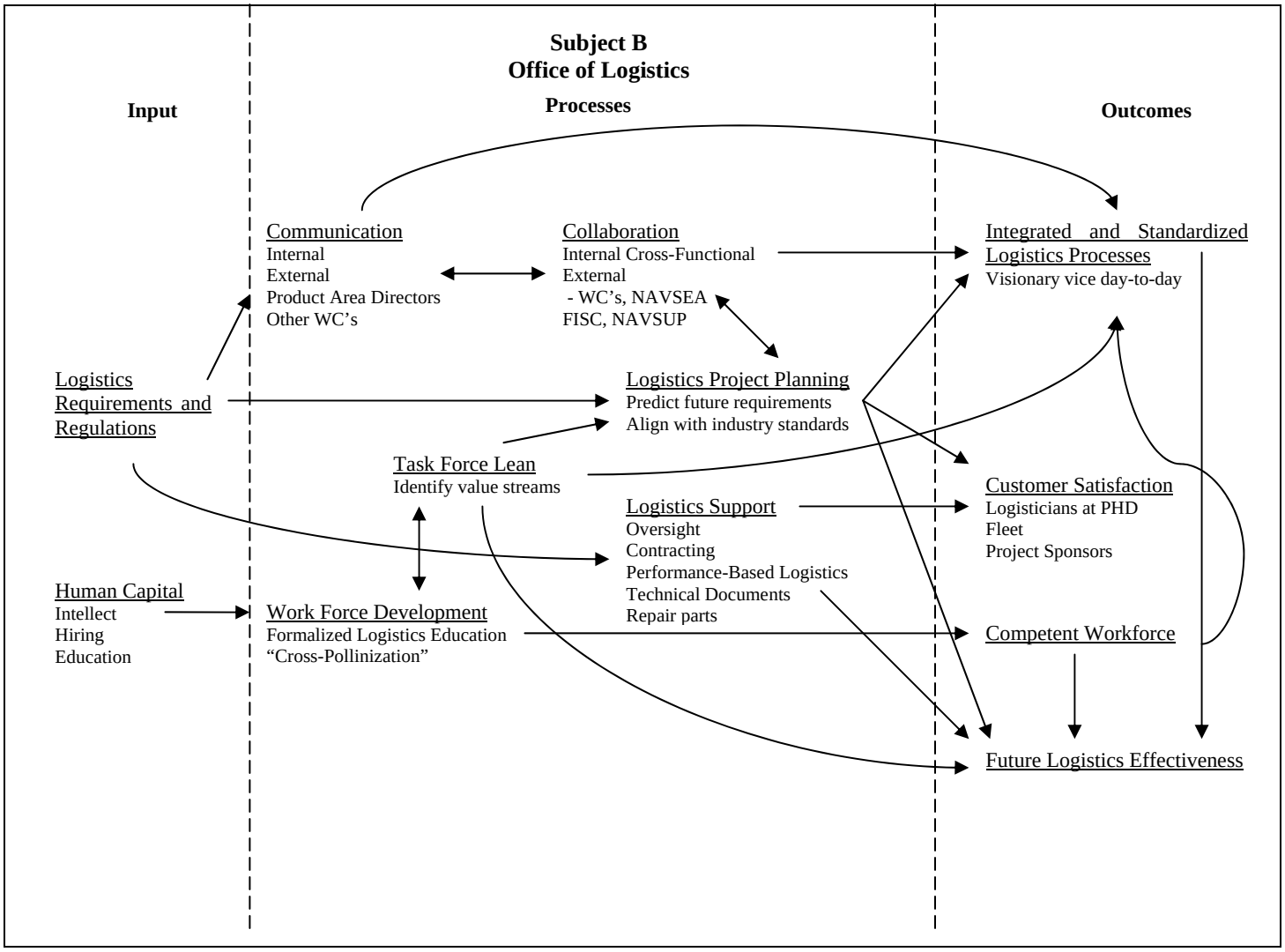

Figure 10. Causal Performance Map – Subject B

2. Office of Logistics

a. Outcomes

Subject B indicated that success in his office is defined by integrating and standardizing logistics processes, developing a competent workforce, satisfying customers, and ensuring future logistics effectiveness. Similar to E&T, the design of the Office of Logistics is intended to be 75 percent visionary and 25 percent day-to-day. Subject B stated that in practice, inverse proportions of focus are more realistic. This is primarily due to a need for integrated and standardized logistics processes that require less day-to-day involvement. Coded logisticians are not centralized within Subject B's office, but rather "farmed out" to the departments with the Office of Technical

Operations. With only four personnel assigned to his office, Subject B indicated that a large amount of attention is paid to logistical activities within these departments. Breaks in continuity in the workforce, identifying requirements, and re-creating programs that fell by the wayside are challenges that Subject B is addressing. To minimize the day-to-day load, Subject B indicated that standardizing processes would be the best method of establishing common business practices for all logisticians at PHD. Subject B indicated that the desired outcome of a competent workforce reinforces this integrated and standardized culture, as an educated and "cross-pollinated" team of logisticians is required to optimize logistics effectiveness at PHD.

Customer satisfaction is again a desired outcome for Subject B. The customer perspective for the office focuses primarily on the logisticians within the lifelines at PHD, which in turn ensures that the fleet receives the logistical support (e.g., technical manuals, engineering changes, ordnance alterations) that they require. Subject B also indicated that program sponsors are customers since the office performs a variety of logistical services for them. The office could be funded to provide logistical support for an entire project or it could be funded to provide oversight of a contractor, or anywhere in between. Subject B alluded to the need for the office to stay at the leading-edge of such initiatives as Performance-Based Logistics (PBL) and other evolving industry standards to maintain this business base.

b. Processes

Subject B indicated that the core processes performed in the Office of Logistics are logistics project planning and logistics support. He indicated that the logistics project planning process aligns current requirements, future requirements and industry standards with actual services performed. Based on the interview with Subject B, the author views logistics support as the project execution process where actual services are performed. This support includes services such as contracting, oversight of logistics projects, managing spare parts, or creating technical documents. Subject B made it clear to the author that every desired outcome in the office is influenced between the two processes of logistics project planning and logistics support. In order to execute

these processes satisfactorily, Subject B indicated that the office relies on the support of other upstream processes.

Similar to E&T, Subject B stated that he serves as an integrator of logistics functions across PHD. As such, he indicated that communication and collaboration are the most important processes to facilitate effective logistics planning and support. One example provided by Subject B indicated that cross-departmental collaboration and communication resulted in applying lessons learned from a previous PBL project to a new project, realizing significant resource savings. On the other hand, Subject B said that it is difficult to break workers out of their set routine. He cited that some workers walk the same number of steps to work, perform meaningful work, read the paper at lunch, perform meaningful work again, and then finish up the day without having shared any information. Subject B was optimistic about more PBL examples in the future, with lesser amounts of the stovepipe mentality. Subject B also indicated that communication and collaboration with other agencies (e.g., WC's, NAVSEA, fleet) is conducted on a limited basis.

Subject B stated that his office is deeply involved in chasing value streams via the Lean process. This directly influences the planning process, how integrated and standardized processes evolve, and also the viability of future logistics efforts (NSWC PHD 2005). Workforce development was cited as essential to ensuring the Lean process is executed properly while also ensuring that a competent workforce is serving the fleet and program sponsors. Subject B placed emphasis on a formalized logistics education that he says is necessary to truly develop a logistics focus within PHD.

c. Inputs

The human capital input is viewed by Subject B as the most critical input within his office. Due to the complex nature of logistics across many differentiated products and services, hiring decisions are the one thing that he says causes him to lose sleep at night. Subject B cited intellect and education as essential entering arguments into how well his organization is suited to achieve the necessary tasks.

Logistics requirements and regulations are another input cited by Subject B that form the boundaries within which the planning, workforce development, and

logistics support processes operate. A better understanding of these requirements and regulations should result in a lesser focus on day-to-day activities.

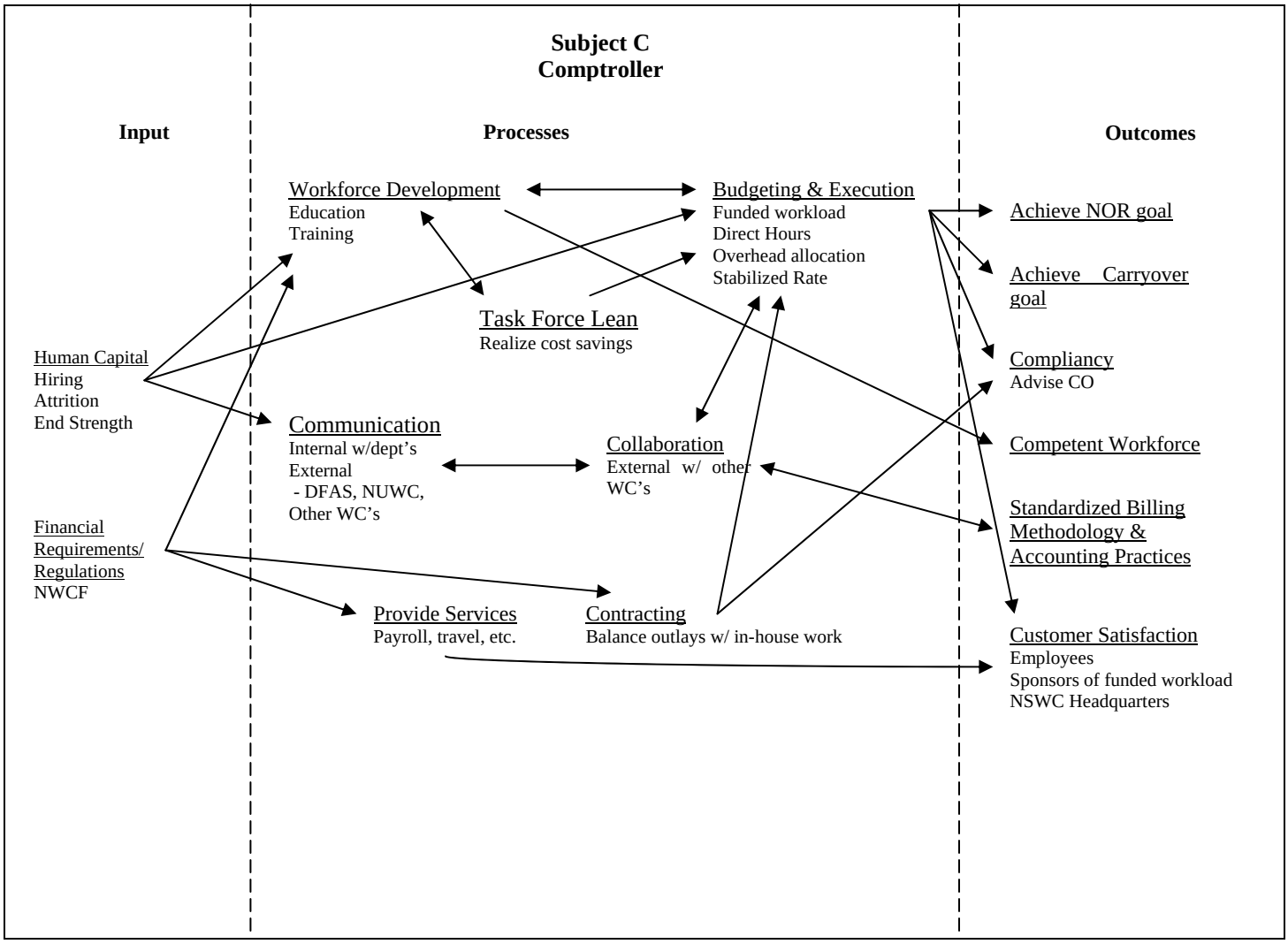

Figure 11. Causal Performance Map – Subject C

3. Comptroller

a. Outcomes

Subject C defined success as meeting Net Operating Result (NOR) and carryover goals, maintaining compliancy with financial regulations, developing a competent workforce, standardizing billing methodology and accounting practices, and customer satisfaction. As a Navy Working Capital Fund (NWCF), PHD operates like a business by charging customers with a stabilized billing rate for work performed and allocating overhead for indirect expenses. Contrary to maximizing profits in a business, the goal of a NWCF is to break even in terms of funded and executed workload. NOR

indicates how far PHD is above or below this break-even point. Meeting the NOR goal is the primary objective for Subject C, followed closely by meeting the carryover goal. Carryover is the balance of funding received that has not been allocated. Subject C stated that measurements of carryover are intended to prevent customers from dumping excess funds at NWCF activities, as Congress views high carryover as a sign of over-funding. Since allowable carryover is based on appropriation and different expenditure rates, Subject C stated that it is essential to measure and closely track carryover to ensure it converges with the goal. (NSWC PHD 2005)

Customer satisfaction from Subject C's perspective deals primary with employees within PHD. The comptroller office provides many services which must be satisfactory for PHD to operate effectively and efficiently. Measurements of services that directly affect employees (e.g., how long a travel claim takes to process, how quickly employees are paid) are indicators Subject C uses to determine whether employees are satisfied. Customer service also extends to NSWC Headquarters and the program sponsors of the funded workload, in terms of whether funds are expended appropriately to provide desired services and products. This ties to the desired outcome of compliancy, as the office must provide guidance to the Commanding Officer and employees at PHD to avoid Anti-Deficiency Act violations. From the perspective of Subject C, a competent workforce minimizes the effort expended to prevent such violations from occurring.

Subject C indicated that standardized billing methodology and accounting practices are critical desired outcomes in his office. Among the six divisions of NSWC, there is great variety in services performed and products produced. Competition among the divisions is discouraged by NSWC, as funded workload is determined in advance based on the core competencies of each division. Subject C indicated that collaboration among the comptroller offices within NSWC is frequent to ensure that the budgeting and execution functions are performed effectively. This collaboration hinges on standardized methodology and practices among the divisions.

b. Processes

Budgeting and execution and collaboration are the most critical processes for Subject C. Collaboration internally across departments and externally among WC's

provides a common foundation for the budgeting and execution process within PHD. Subject C alluded to the communications process facilitating this collaboration. The budgeting and execution process itself directly facilitates achievement of NOR, carryover, and customer satisfaction goals. This process must balance direct hours with overhead allocation, and also in-house work with contractual outlays. Subject C stated that costs savings from Task Force Lean events add an additional complication into the process, as capacity is ideally freed up for more work to be accomplished with the same funded workload. Throwing PHD's stabilized rate into the mix, it is clear to the author that this process is a complex puzzle that must be managed closely.

Subject C indicated that workforce development process plays heavily into how complex the process can become. An example was a department that was having difficulty meeting financial goals over a two-month period. The department was subjected to periodic financial reviews that were time-intensive in terms of preparation and the review itself, for both the department and the comptroller's office. Once the department was properly trained and back on track, the periodic reviews stopped. This provided an incentive for the department to stay on track and support execution of the budget. Subject C indicated that other departments are learning from this example, and of late the budgeting and execution process is running smoothly.

c. Inputs

Human capital is again the most critical input for Subject C. From his perspective, the important factors are the hiring, attrition, end strength, and "productive workyear" numbers that form the basis of his budget. Everything from holidays, to unplanned days off, to Presidential deaths must be figured into the budget for better accuracy. Financial regulations are another important input into the processes, as they again define the boundaries within which PHD can operate in a financial sense.

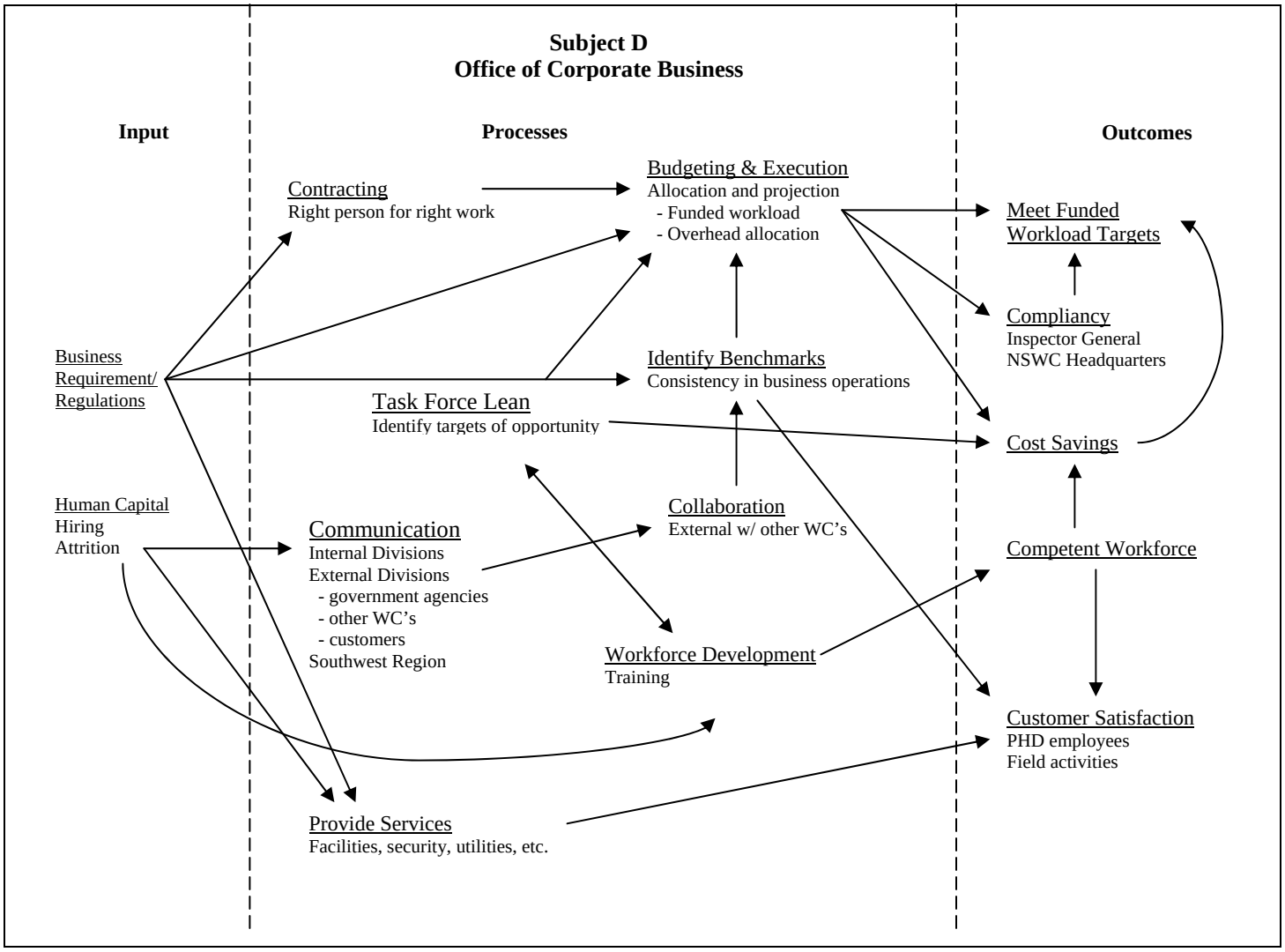

Figure 12. Causal Performance Map – Subject D

4. Office of Corporate Business

a. Outcomes

Subject D defined success as meeting funded workload targets, realizing cost savings through various processes, ensuring compliance with regulations, developing a competent workforce, and satisfying customers. Corporate business within PHD differs from comptroller functions in that in deals primarily with overhead. Facilities upkeep, warehousing, security, and utilities are but a few of the services provided by this office. The focus of services, and perspective of customers, is internal within PHD. Subject D indicated that his greatest challenges, and most critical outcomes, are meeting funded

workload targets while ensuring compliance with regulations. Subject D stated that there is uncertainty within regulations across so many activities, creating an imbalance between compliance and running the day-to-day business.

Subject D indicated that a lack of common business rules across NSWC encourages a day-to-day focus as divisions search for benchmarks and standards for various activities. Within this challenging environment, corporate business must continue to provide satisfactory services to employees and field activities, otherwise department operations could be negatively affected. This highlights the customer satisfaction outcome, which is viewed by Subject D as providing services strictly to PHD employees.

b. Processes

Benchmark identification is the most critical process for Subject D. It was made clear to the author that uncertainty within core functions of the office prevents optimization of effort in terms of both planning and execution. Subject D indicated that he wrestles with a variety of benchmark issues within areas such as cell phone usage, training allocation, facility modernization, and warehouse management responsibilities. In order to eliminate uncertainty in areas such as these, he emphasized that common business rules must be established. In the author's opinion, the collaboration and communication processes should be used to ensure everyone is on the same page internally within PHD, while also establishing commonalities among WC's.

Consistency of business operations drives the budgeting and execution process for corporate business, as less uncertainty results in a straighter path to meeting funded workload goals. As corporate business deals primarily with overhead, budgeting and execution is directly affected by overtime, hiring, loss of direct hours in programs, and other increased requirements (training, leave, budget marks, etc.). According to Subject D, Task Force Lean events identify "targets of opportunity" for cost savings that can relieve some of this budget pressure. Conversely, more expensive contractual outlays are often necessary due to constrained abilities to respond to new tasks and initiatives. Similar to the comptroller office, this creates a complex puzzle in terms of budgeting and execution.

c. Inputs

Human capital and regulations are again essential inputs for corporate business. Regulations provide a foundation for common business rules and how corporate business plans and executes. Employees within corporate business are essential in terms of both responding to a volatile business environment and providing continuity of experience to the overall organization.

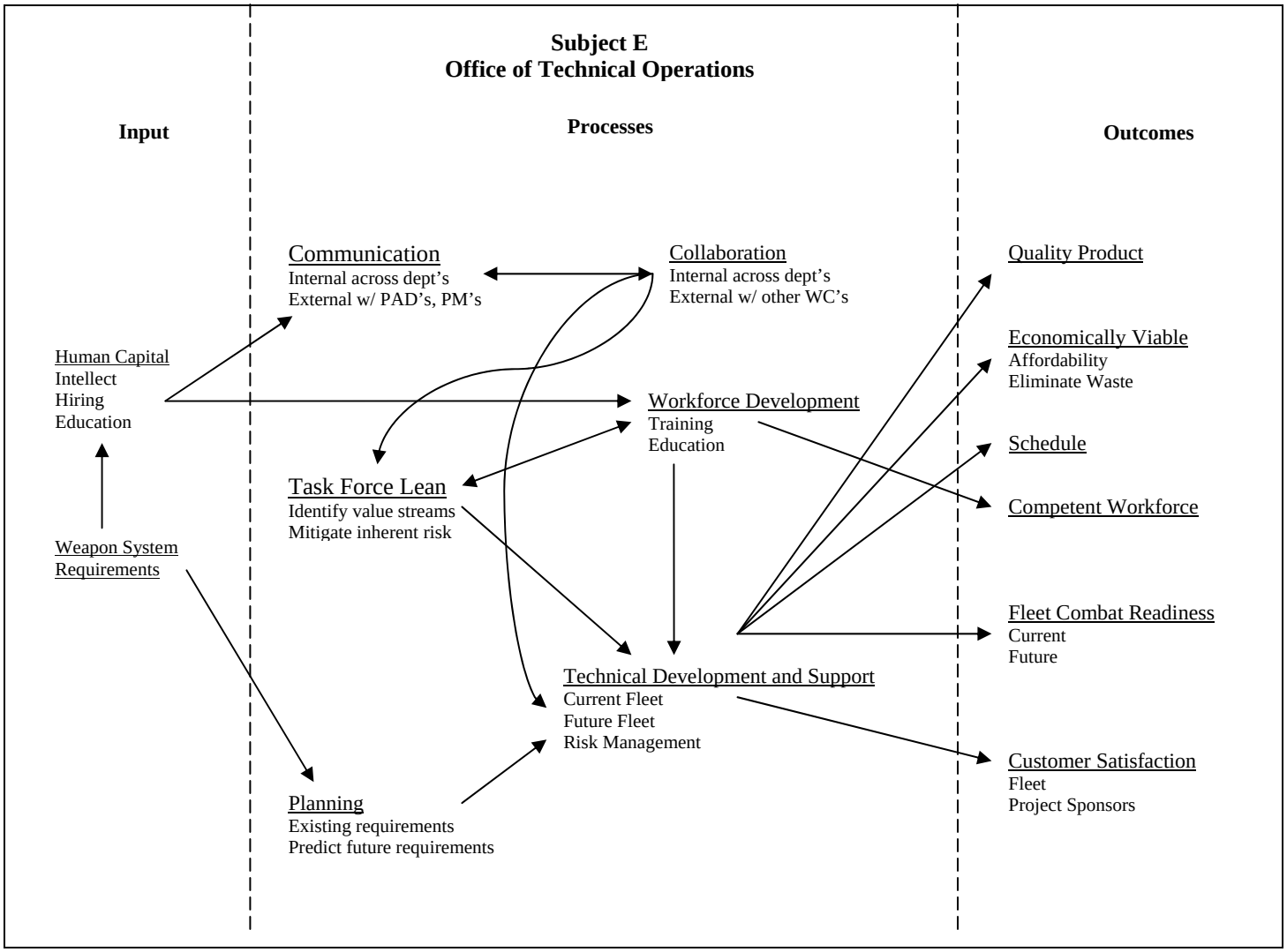

Figure 13. Causal Performance Map – Subject E

5. Office of Technical Operations

a. Outcomes

In the author's opinion, the Office of Technical Operations is by far the most complex organization within PHD. With five departments spread over five geographic locations, providing support to over 50 surface warfare systems, many factors are involved in determining success for this office. Subject E stated that first and foremost, current and future fleet combat readiness are the desired outcomes. He indicated that readiness is dependent on building reliability, maintainability, and supportability factors into products and services up front. Subject E discussed the affect of these factors on operational availability, which is discussed in Chapter V.

In terms of customer satisfaction, Subject E views the fleet as the primary customer with sponsors of the funded workload as an important secondary customer. Subject E further stated that quality products delivered on schedule are essential outcomes, within the constraints of economic viability. In the author's opinion these outcomes also directly support customer satisfaction for both the fleet and program sponsors. Subject E indicated that the success of each of these outcomes rests directly on the workforce, placing emphasis on competency.

b. Processes

The technical development and support process directly influences fleet combat readiness, customer satisfaction, quality, cost, and schedule outcomes. In the author's opinion, technical development can be seen as project planning, while technical support can be seen as project execution. It was made clear to the author that the project execution process is fed by the project planning process in accordance with existing and future weapon system requirements, development of the technical workforce, collaboration across offices and departments, and efficiencies realized from Task Force Lean events.

Subject E indicated that collaboration is an especially important process within this office. In 2003 NSWC completed implementation of "Product Area Directors" (PAD) that directly interface with customers (program sponsors) across 12 different product areas. These PAD's are spread across the six divisions of NSWC,

strategically located where they are most needed. The "Surface Ship Combat Systems" PAD is located at PHD, and has "customer advocates" assigned to his office. These customer advocates are located within each of the five departments of Technical Operations, and they communicate and collaborate with department managers, offices, PAD's, and customers for various programs and projects. Communication and collaboration with PAD's and other WC's are critical to ensuring concerns are addressed, outside activities are on the same page, and project health is at the desired level. Collaboration with E&T is especially important, as the future direction of the office is determined through this interaction.

Developing a capable workforce is another critical process for Subject E. Shaping the workforce through training and education to stay at the leading edge of technology is essential to maintaining a workforce suited to knowledge-based work. Assigning the right person to the right work is key to effective allocation of direct hours and completion of projects in a timely manner.

Managing risk is a specific concern for Subject E. When processes are "Lean-ed" and steps are eliminated, he indicated that a sanity check should be conducted to ensure that the reasons for including those steps are now invalid. Ensuring that requirements and performance are not compromised for cost savings is an important consideration for Subject E. He indicated that efficiencies should be realized without serious impact to the safety, operational availability, and reliability of warfare systems. Subject E stated that the Safety, Effectiveness, and Affordability Review (SEAR) program is utilized within all projects at PHD to ensure risk is managed satisfactorily. The components of the SEAR are discussed at length in Chapter V.

c. Inputs

Weapon systems requirements are the most critical input for the Office of Technical Operations. Subject E indicated that they are the entering argument not just for planning, but also for hiring decisions to effectively shape the workforce. This indicated to the author that human capital is also a critical input for Subject E.

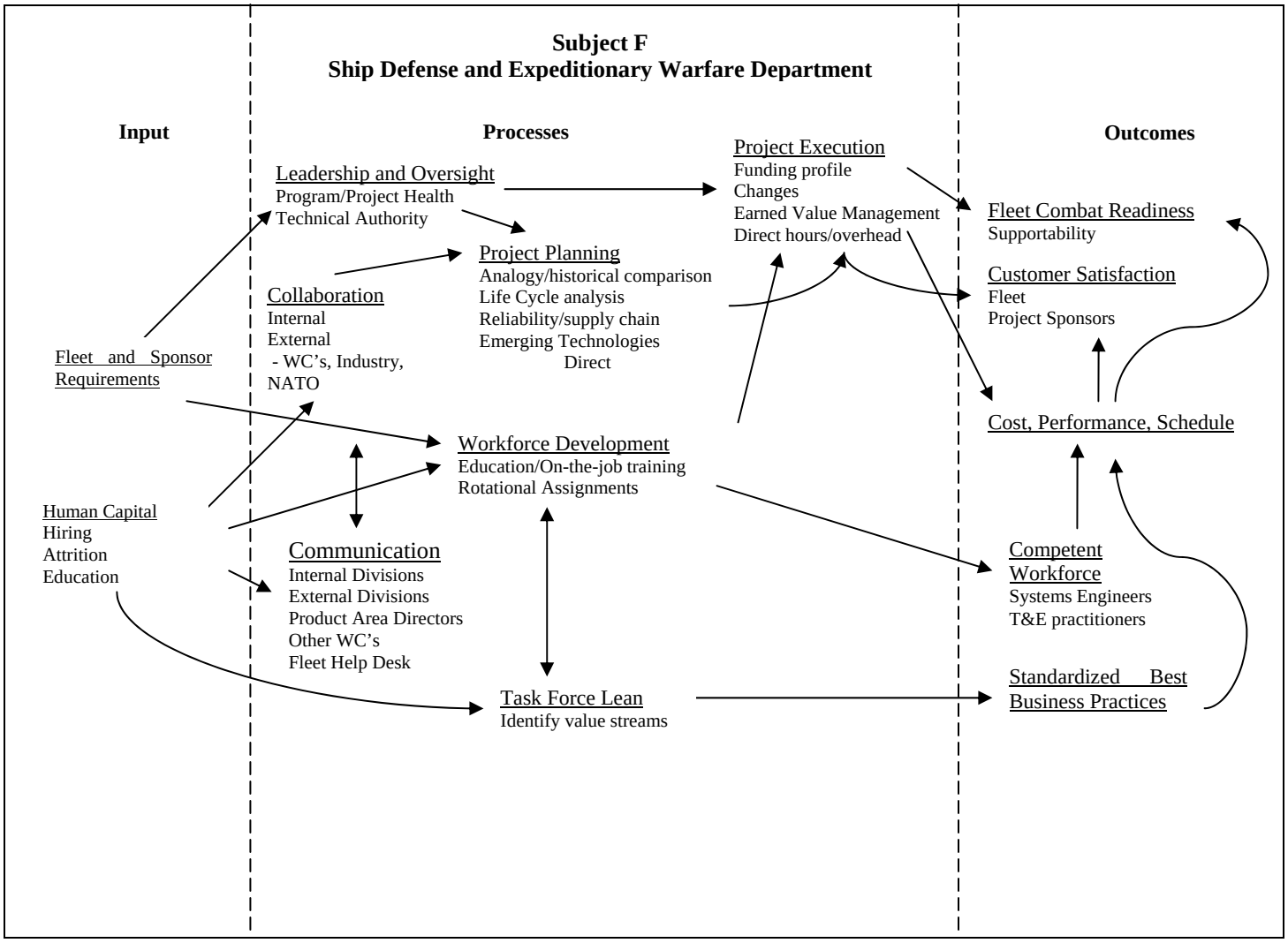

Figure 14. Causal Performance Map – Subject F

6. Ship Defense and Expeditionary Warfare Department

The Ship Defense and Expeditionary Warfare Department (S-Department) is the second-largest department at PHD with a 2005 funded workload of approximately $123 million. With arguably the most diverse operations among all departments, systems supported include radars, missiles, gun systems, and underway replenishment. (NSWC PHD 2005) The author's mentor at PHD recommended analysis of this department due to this comprehensive nature of operations.

a. Outcomes

Subject F defined success as improving fleet combat readiness, satisfying customers, developing a competent workforce, and standardizing best business practices. Meeting cost, performance, and schedule requirements is also a desired outcome. The primary focus is improvements in operational availability, reliability, maintainability, and supportability of fleet warfare systems. Subject F's perspective of customers is again primarily the fleet, with project sponsors coming in a close second. Subject F indicated a competent workforce is essential in maintaining a consistent level of effort in the provision of services and products. Standardized business practices are also essential to ensure everyone in S-Department is on the same page in terms of business operations, execution of work, and reporting up the chain of command.

b. Processes

Subject F indicated that the two most essential processes within S-Department are project planning and project execution. Interview data collected indicated that these processes directly support fleet combat readiness, customer satisfaction, and cost, performance, schedule outcomes. Within project planning, Subject F stated that accurate analogy and historical comparisons of previously-executed projects play a critical part in designing new projects. Additionally, he stated that accurate life-cycle analysis of projects is necessary to capture costs connected with reliability, maintainability, and other supply chain factors over the life of the system. He further emphasized that contrary to a historical analysis, emerging technologies must also be considered to maximize the effectiveness of in-service engineering initiatives. The project planning process is also constrained by budgeted direct hours and overhead allocation.

Based on the interview with Subject F, it is clear to the author that the planning process in S-department feeds directly into project execution. The project execution process meticulously tracks deviations from the project funding profile developed in the planning phase, and also changes in planned requirements. Subject F indicated that the Earned Value Management System (EVMS) is a management tool frequently used to integrate cost, performance, and schedule factors for a project, whether

work is performed "in-house" or contracted out. Within EVMS, the cost performance index (CPI) compares budgeted cost of work performed (BCWP) to actual cost of work performed (ACWP). Cost variance (CV) is BCWP less ACWP. The schedule performance index (SPI) compares BCWP to budgeted cost for work scheduled (BCWS). Schedule variance (SV) is BCWS less BCWP. This is illustrated in Table 3. Subject F also stated that straight-lined spend plans are used to track level-of-effort contracts, with step functions linked to surge activities within applicable schedules.

CPI	CV	SPI	SV
Budgeted Cost of Work Performed/ Actual Cost of Work Performed	Budgeted Cost of Work Performed – Actual Cost of Work Performed	Budgeted Cost of Work Performed/ Budgeted Cost of Work Scheduled	Budgeted Cost of Work Performed – Budgeted Cost of Work Scheduled

Table 3. Earned Value Management System (Naval Postgraduate School 2005)

With many projects in motion at any given time within S-Department, Subject F indicated that leadership and oversight are essential for two reasons. First, it is cited as necessary to monitor the overall project health and progress of workload execution. Second, it is cited as necessary to ensure technical authority is not violated, and that technical warrant holders are meeting their responsibilities. Subject F indicated that these safeguards support PHD as a sustaining organization characterized by continuous improvement. They also support the outcome of customer satisfaction, both in terms of improved products and services for the fleet and meeting project sponsor expectations.

Collaboration and communication are again essential, but distinct in the direct interface S-Department has with PAD's, the fleet, and outside agencies such as NATO. As previously mentioned, customer advocates are located within each department to serve as liaisons among customers, PAD's, and departmental projects. NSWC as a cost-effective single enterprise hinges on these relationships. S-Department also has direct interface with the fleet via the "fleet help desk," providing maintenance and operational assistance via distance support and assist visits. Additionally, S-

Department is responsible for the NATO Sea Sparrow missile system, leading to close relations with NATO headquarters and other NATO countries.

Workforce development is again a key process emphasized by Subject F. Rotational assignments are utilized within the department to encourage a cross-functional workforce capable of adapting to changing requirements. Junior professionals are young engineers who are provided internships to grow within the organization from the bottom-up. Workers are also trained in the Task Force Lean methodology to identify value streams and standardize best business practices across PHD.

c. Inputs

Processes and outcomes within S-department are derived from fleet and sponsor requirements from the outset. Human capital strategy is again pivotal in support of core competencies within the department. Both of these inputs are equally critical across each department within the Office of Technical Operations.

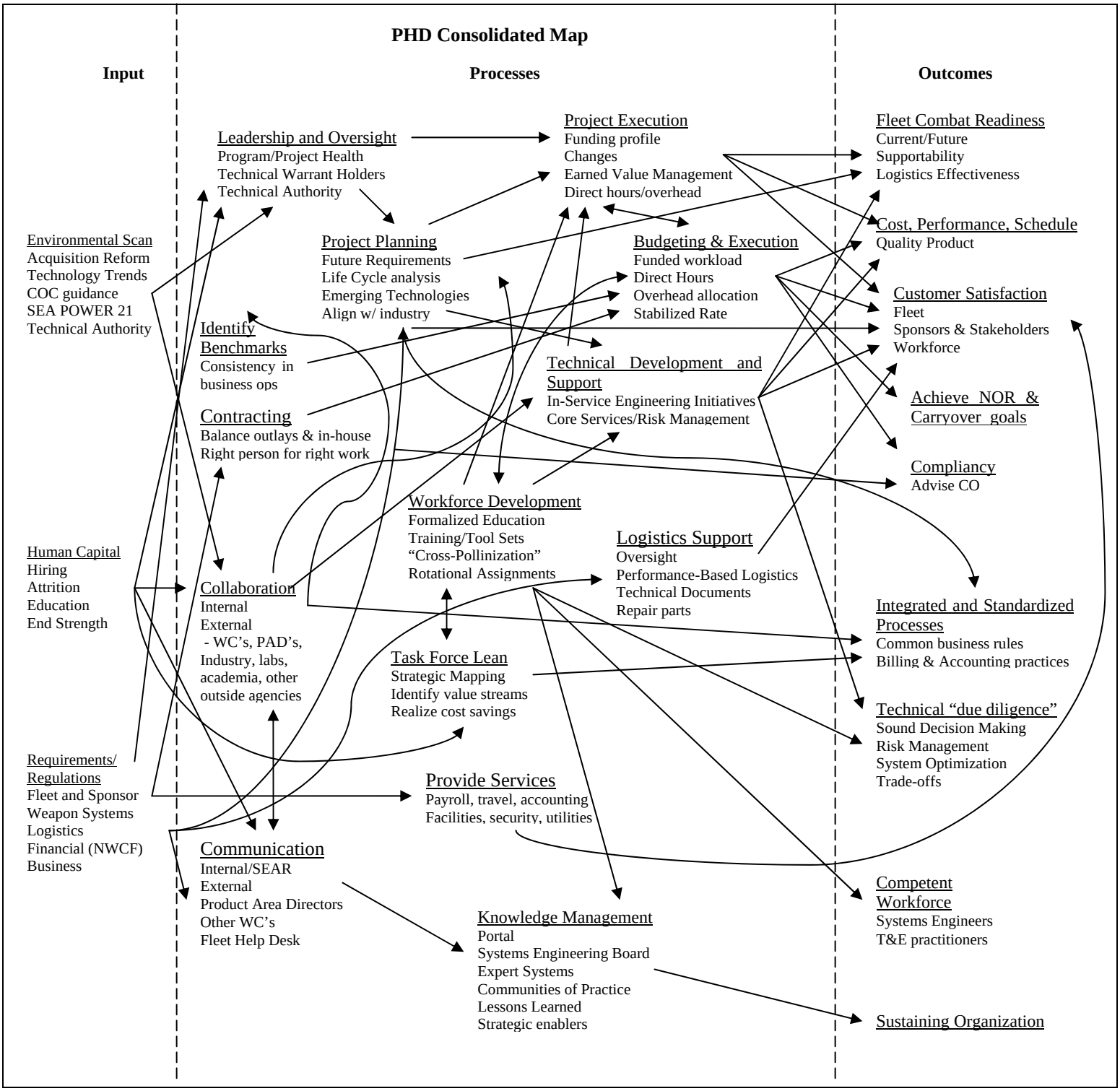

Figure 15. PHD Consolidated Causal Performance Map

7. Consolidated Causal Performance Map

Figure 15 reflects the complexity of interactions among inputs, processes, and outcomes captured from the tacit knowledge of line managers at PHD. In Chapter V the author will analyze these data in terms of critical performance variables and suggested balance of perspectives within the organization. Additionally, existing performance metrics within PHD will be identified and assessed in terms of federal guidance alignment and overall appropriateness and quality of metrics.

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V. ANALYSIS AND ASSESSMENT OF EXISTING METRICS

A. CRITICAL PERFORMANCE VARIABLES

The causal performance maps developed for PHD openly communicate the factors that PHD line managers view as critical to success. After conferring with interview subjects to verify the accuracy of the maps, critical performance variables (CPV) were selected by the author for each office or department based on performance drivers within the maps. Recall that while all performance drivers are important, only some are truly critical to success at PHD. Although interviews indicated that there is a wide variation in the type of work and services performed within each office or department, there is a commonality in CPV's that define success across PHD. Table 4 illustrates CPV's for each office and department interviewed, with common CPV's within PHD illustrated in the last column. Figure 16 also illustrates these common CPV's, but in the format of a causal performance map for better visualization.

Identifying CPV's should place focus squarely on the performance drivers for success within PHD. The common CPV's in Figure 16 are a synchronized "story of success" for PHD, as line managers agree on the ingredients required to achieve success. In the following analysis, the author organizes CPV's within the balanced scorecard perspectives discussed in Chapter II. The purpose of this is to ensure each perspective is represented in PHD's "story of success," while also establishing a balanced foundation for assessment of existing metrics at PHD. Prior to each perspective, the author includes a figure to provide a visual illustration of the CPV's applicable within each perspective.

Engineering & Technology	Logistics	Comptroller	Corporate Business	Technical Operations	S-Department	Common CPV's
Inputs Human Capital Fleet Requirements Acquisition Reform Technical Authority Technology Trends Senior Guidance	Inputs Human Capital Logistics Requirements	Inputs Human Capital Financial Regulations	Inputs Human Capital Business Requirements and Regulations	Inputs Human Capital Weapon System Requirements	Inputs Human Capital Fleet and Sponsor Requirements	Inputs Human Capital Requirements and Regulations
Processes Collaboration Communication Leadership and Oversight Task Force Lean Future Workforce Development Project Planning Knowledge Management In-Service Engineering Initiatives	Processes Collaboration Communication Task Force Lean Workforce Development Project Planning Logistics Support (Provide Services)	Processes Collaboration Communication Task Force Lean Workforce Development Budgeting and Execution Contracting Provide Services	Processes Collaboration Communication Task Force Lean Workforce Development Budgeting and Execution Contracting Provide Services	Processes Collaboration Communication Task Force Lean Workforce Development Planning Technical Development and Support (Project Execution)	Processes Collaboration Communication Leadership and Oversight Task Force Lean Workforce Development Project Planning Project Execution	Processes Collaboration/Knowledge Management Communication Leadership and Oversight Task Force Lean Workforce Development Project Planning Project Execution Budgeting & Execution
Outcomes Customer Satisfaction Competent Workforce Fleet Combat Readiness Sustaining Organization Technical due diligence	Outcomes Customer Satisfaction Competent Workforce Future Logistics Effectiveness Integrated and Standardized Processes	Outcomes Customer Satisfaction Competent Workforce Achieve NOR and Carryover Goals Compliancy Standardized Billing & Accounting Practices	Outcomes Customer Satisfaction Competent Workforce Meet Funded Workload Targets Compliancy Cost Savings	Outcomes Customer Satisfaction Competent Workforce Fleet Combat Readiness Quality Product Economically Viable Schedule	Outcomes Customer Satisfaction Competent Workforce Fleet Combat Readiness Cost, Performance, Schedule Standardized Best Business Practices	Outcomes Customer Satisfaction Competent Workforce Fleet Combat Readiness Cost Performance Schedule Meet NOR and Carryover Goals Standardized Processes

Table 4. CPV's Across PHD

Common CPV's Across PHD		
Input CPV's	**Processes CPV's**	**Outcome CPV's**
	LEADERSHIP & OVERSIGHT	FLEET COMBAT READINESS
HUMAN CAPITAL	PROJECT PLANNING	CUSTOMER SATISFACTION
	PROJECT EXECUTION	COST, PERFORMANCE, SCHEDULE
REQUIREMENTS/REGULATIONS	BUDGETING & EXECUTION	COMPETENT WORKFORCE
	WORKFORCE DEVELOPMENT	MEET NOR AND CARRYOVER GOALS
	COMMUNICATION	STANDARDIZED PROCESSES
	COLLABORATION/KNOWLEDGE MANAGEMENT	
	TASK FORCE LEAN	

Figure 16. Common CPV's Across PHD

1. Learning and Growth Perspective

In applying the learning and growth perspective to PHD, the question that should be answered is "To achieve our vision, how will we sustain our ability to change and improve (Kaplan and Norton 1992)?" The CPV's within Figure 17 should answer this key question.

	Learning and Growth Perspective	
INPUT CPV's	**PROCESS CPV's**	**OUTCOME CPV's**
	WORKFORCE DEVELOPMENT	
HUMAN CAPITAL	COMMUNICATION	COMPETENT WORKFORCE
	COLLABORATION/KNOWLEDGE MANAGEMENT	
	TASK FORCE LEAN	

Figure 17. Learning and Growth Perspective CPV's

a. Human Capital Input

Interviews indicated that highly skilled, experienced workers are required to provide effective support for over 50 surface warfare systems that fall under PHD. Testing new missiles, integrating new computer baselines, and upgrading fire control radars are not the sort of work that entry-level personnel can likely accomplish. The

average age of the workforce at PHD is 47 years, indicating a reliance on experience. Increasing numbers of these workers are eligible to retire. Additionally, NSWC Headquarters directed a reduction in work years by 5 percent each year for the next three years, all while sustaining current performance levels (NSWC PHD 2005). This translates into more attrition, fewer hiring opportunities, and constant or increasing requirements. The challenge here is obvious as the weight of the future workforce hangs on the effectiveness of a limited number of hiring decisions. In terms of human capital, the learning and growth of PHD depends directly on these decisions. Interviews reinforced how heavily this weighed on the minds of line managers.

However, interviews also indicated that attrition challenges present an opportunity for learning and growth. Since PHD is a changing organization that must constantly adapt to emerging technologies and innovative processes, replacing a retiring workforce can work to the organization's strategic advantage. An example discussed in the E&T interview emphasized the need for modeling experts to transition to a new method of evaluating naval gunfire systems. Developing that skilled worker from within would likely require a large investment in time, training, and supervision. Hiring a new worker that matches the requirement for a modeling skill set could alleviate this pressure on resources. Furthermore, hiring a new worker with a cross-functional intellect could not only meet the near-term requirement, but provide flexibility in the workforce for future change.

b. Workforce Development Process

While the mandatory attrition previously discussed constrains PHD's ability to control the number of workers that can be hired or retained, the line managers indicated that they have significant control in how they develop their workforce. One of PHD's core values is "continual development of our people (NSWC PHD 2005)." PHD utilizes rotational assignments of technical department employees to encourage cross-functionality, communication, and collaboration. Additionally, supervisors in technical departments provide counseling and mentoring through Individual Development Plans (IDP) and Individual Performance Plans (IPP). These plans link individual goals to department action plans, which in turn are linked to strategic objectives (NSWC PHD

2005). From the author's perspective, these workforce development actions place focus squarely on learning and growth within PHD.

The Junior Professional (JP) program "grows" new engineers from the bottom-up, providing them with an opportunity to gain hands-on experience with technical departments and possibly long-term employment at PHD. In a similar vein, PHD collaborates with the Naval Postgraduate School to produce certifications and degrees in systems engineering and systems analysis. Furthermore, PHD allocates the largest portion of overhead to training, demonstrating a commitment to developing the workforce. Resources are also dedicated to training the workforce in Task Force Lean, which aims to create a culture of efficiency as the workforce recognizes and takes action on process improvement opportunities. Each of these actions and initiatives encourage a culture of innovation, promoting a workforce that anticipates and responds to a changing environment. (NSWC PHD 2005)

c. Task Force Lean Process

Lean deserves specific mention in terms of the learning and growth perspective. Application of the Lean methodology is taken from a strategic perspective at PHD. The Executive Staff Board at PHD, chaired by the Commanding Officer, holds a strategic planning session that identifies the best "targets of opportunity" for Lean savings. These are typically complex processes of significant cost with potential inefficiencies. When a process is "Lean-ed," the entire process is mapped out to identify an extremely detailed resource-to-task allocation. The process is then restructured to eliminate waste of resources and realize cost savings. The eliminated wastes result in increased capacity to "redeploy personnel" to perform additional tasks. The estimated cost savings are reported out upon completion of the Lean event, and then it is up to the activity that owns the process to realize those cost savings. (NSWC PHD 2005)

d. Communication and Collaboration Processes

Line managers indicated that sharing information, building complementary relationships, and managing knowledge are each critical in sustaining the ability to change and improve. Although departments vary greatly in terms of the final products or services they provide, interviews made it clear to the author that there are

many opportunities to capture lessons learned and existing tacit knowledge across departmental lines. The logistics interview provided an excellent example of this in the lessons learned from a PBL initiative. Instead of starting a new project from ground zero, departments shared information on other PBL initiatives. This communication across boundary lines allowed the new PBL project to begin further along the learning curve (NSWC PHD 2005). The author believes this type of efficiency can be realized in basic functions such as creating technical manuals, contracting, planning and executing tests, certifications, and other common functions across PHD.

Interviews made it clear to the author that a system and process that manages the sharing of information is essential for learning and growth to occur at PHD. The implementation of a command portal has taken long strides in capturing lessons learned, requirements and regulations, technical information, existing performance metrics, and other useful documentation (NSWC PHD 2005). PHD also has "communities of practice," which are teams composed of subject matter experts that compare processes to determine best practices (NSWC PHD 2005). Other venues such as the Systems Engineering Board and Systems Supportability Board bring together cross-functional members within projects to share information and encourage adoption of engineering and logistics best practices (NSWC PHD 2005). The initiatives and processes that the author observed emphasized the importance of communication and collaboration at PHD.

As evidenced during interviews with subjects, communication and collaboration external to PHD are also essential. While the staff of the product area director (PAD) for Surface Ship Combat Systems is located at PHD, extensive communication and collaboration are necessary with other WC's and the PAD's for Ship and Ship Systems, Force Level Warfare Systems, Littoral Warfare Systems, Navy Strategic Weapon Systems, Ordnance, Homeland & Force Protection, and Surface Warfare Logistics and Maintenance (NSWC PHD 2005). This collaboration supports NSWC's strategic objective of "operating as a single, cost-effective enterprise." Additionally, relationships with industry, government laboratories, and academia are critical for awareness of emerging technologies, processes, and standards.

e. Competent Workforce Outcome

A competent workforce was consistently articulated by line managers as critical to success at PHD. Exercising due diligence in technical warrant holder responsibilities was specifically highlighted. The competent workforce outcome is directly linked to PHD's strategic objectives, "Develop and Reward Our Workforce" and "Embrace New Technology and Develop a Culture of Innovation."

2. Internal Business Processes Perspective

CPV's within the internal business processes perspective should answer the question, "To satisfy our shareholders and customers, what business processes must we excel at (Kaplan and Norton 1992)?" The CPV's within Figure 18 should answer this question. The author interprets shareholders in this context as the chain of command and providers of PHD's funded workload. Customers include the fleet, program sponsors, and employees at PHD.

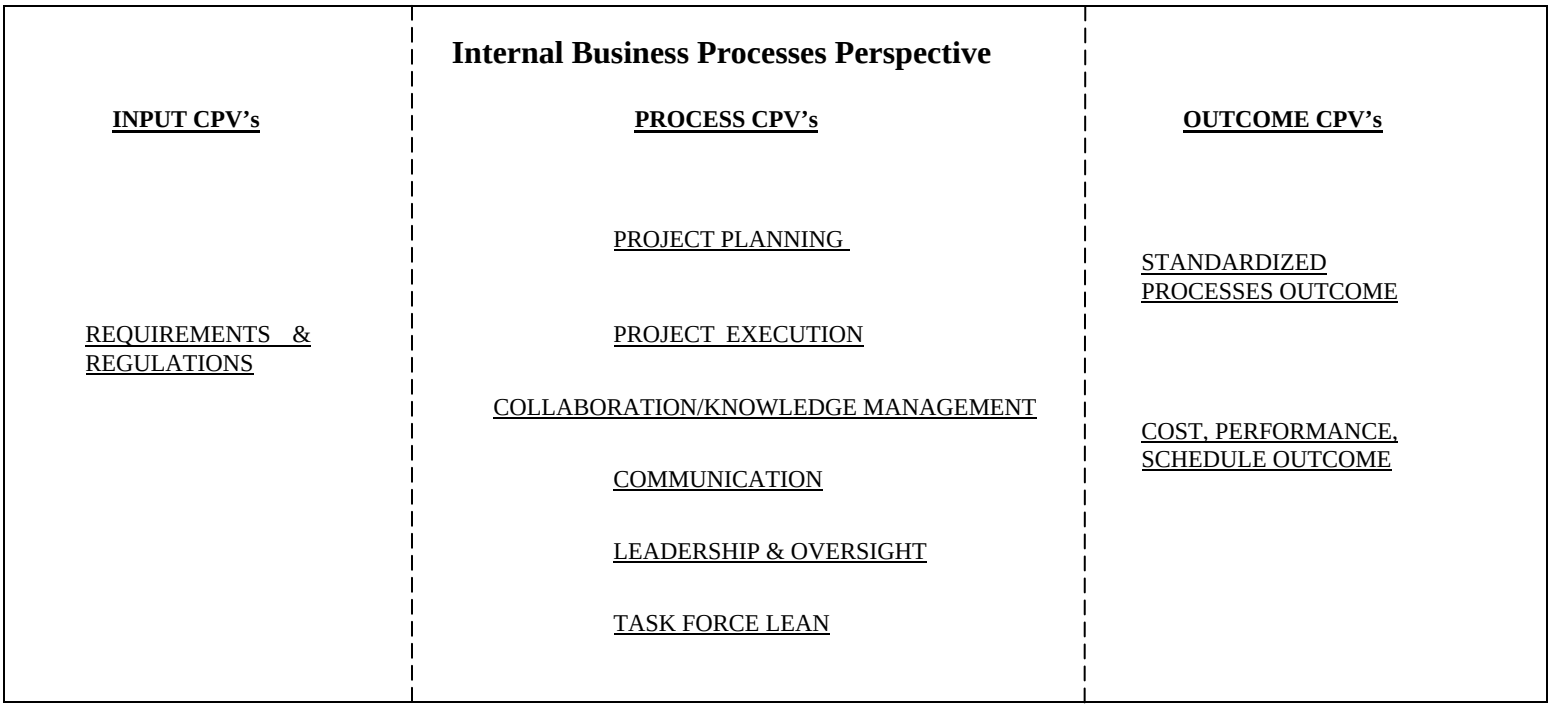

Figure 18. Internal Business Processes CPV's

a. Requirements and Regulations Input

Many different requirements and regulations feed into the internal business processes at PHD. These include technically-oriented items such as weapon

system operating parameters, fleet maintenance policy and procedures, logistics policy, acquisition reform, and NAVSEA instructions. They also include administrative items such as Defense Travel System requirements, purchase card requirements, security requirements, and facility upkeep requirements (NSWC PHD 2005). These inputs are essential to PHD in that they establish the constraints within which the organization must operate. In the author's opinion, employees that need to manage to these requirements should have them readily available to examine as necessary.

b. Project Planning Process

Interviews indicated that established benchmarks, industry standards, existing requirements, and future requirements should be considered as entering arguments into the project planning process. From an internal business processes perspective, this indicates that PHD should consistently excel at identifying benchmarks and requirements to support planning efforts.

In terms of cost, interviews indicated that estimations are conducted utilizing historical project comparisons, life cycle cost projections, and reliability and supply chain analyses. While cost estimations obviously provide cost information, they also provide a matching performance standard at the projected cost. As stated in the customer perspective, line managers emphasized that attributes such as reliability, maintainability, availability, and supportability should be built within the performance standard to encourage an accurate projection of the life-cycle cost and effectiveness. From an internal business processes perspective, planning these attributes into projects should be a process that PHD excels at.

Line managers indicated that schedule and performance variables are interrelated, as schedule is determined based on an estimated number of direct and overhead hours needed to accomplish planned work to specification (NSWC PHD 2005). From an internal business processes perspective, PHD should excel at accurately determining required direct and overhead hours within the planning process.

c. Project Execution Process

From an internal business processes perspective, the project execution process is where the "rubber meets the road" at PHD. The output of this process is the

basket of products and services that directly impact fleet combat readiness, customer satisfaction, and achievement of cost, performance, and schedule goals. Similar to budgeting and execution, line managers stated that they meticulously track contractual outlays, direct hours, and overhead to ensure projects are executing appropriately. Additionally, project execution must track performance and schedule for each project (NSWC PHD 2005). From an internal business processes perspective, PHD should excel at tracking these variables within project execution.

As discussed in Chapter IV, EVMS is used to track the progression of cost, performance, and schedule within each project. Line managers indicated that difficulties arise when changes occur in the baseline for measurement within EVMS. Interviews indicated that changes often occur in projects for reasons such as changing requirements, funding issues at the program level, or emerging technologies. Data collected make it clear to the author that project execution from an internal business process perspective is very dynamic and challenging to manage.

Interviews also indicated that contracting and project execution go hand-in-hand, as PHD uses direct citation funding for products and services that do not fall within their core competencies or capacity (NSWC PHD 2005). From an internal business perspective, PHD should excel at identifying appropriate circumstances and sources for contracting.

d. Leadership and Oversight, Communication, and Collaboration

Line managers indicated that the leadership and oversight process reinforces and validates project planning and project execution processes. Examples of line manager involvement in projects include oversight of contracts, ensuring technical authority is not violated, implementing new methods or standards, or performing internal audits (NSWC PHD 2005).

As discussed in the learning and growth perspective, internal and external collaboration are necessary within most projects. Line managers indicated that an integrated effort within projects is necessary to shift from a day-to-day reactive focus to a more forward-looking, visionary focus. They also cited a great need for standardized

processes and common business rules within internal business processes to realize more productivity from efforts. Interviews reiterated that stakeholders from engineering, logistics, financial, technical operations, and external functions should be thoroughly involved in projects utilizing a standard approach. Interviews made it clear to the author that more integrated involvement reduced risk of estimating errors and potential oversights.

e. Task Force Lean Process

Line managers agreed that establishing a pervasive "Lean mentality" at PHD should enhance project planning and project execution, as well as lead to standardized processes. If the workforce gains the ability to systematically identify and implement process efficiencies, resources should be freed up to relieve pressure on planning and execution constraints. If everyone at PHD is onboard with this philosophy, the author believes that Lean will become a standardized process that streamlines business operations across the entire command

f. Cost, Schedule, Performance Outcome

Meeting cost, schedule, and performance targets was a goal mentioned more than any other goal by line managers. For this reason, the author believes it is the most deeply rooted outcome within PHD's internal business processes. As previously stated, this outcome links directly to PHD's strategic objective, "Improve the Efficiency, Delivery and Quality of Our Products…Right Work at the Right Cost."

g. Standardized Processes Outcome

Within internal business processes, line managers indicated that standardized processes are essential for success at PHD. This outcome links directly to PHD's strategic objective, "Operate As a Seamless Organization by Improving Enterprise Collaboration."

3. Customer Perspective

This perspective seeks to answer the question, "To achieve our vision how should we appear to customers (Kaplan and Norton 1992)?" The CPV's within Figure 19 should answer this question. Customer stakeholders for PHD include the fleet and sponsors of the funded workload.

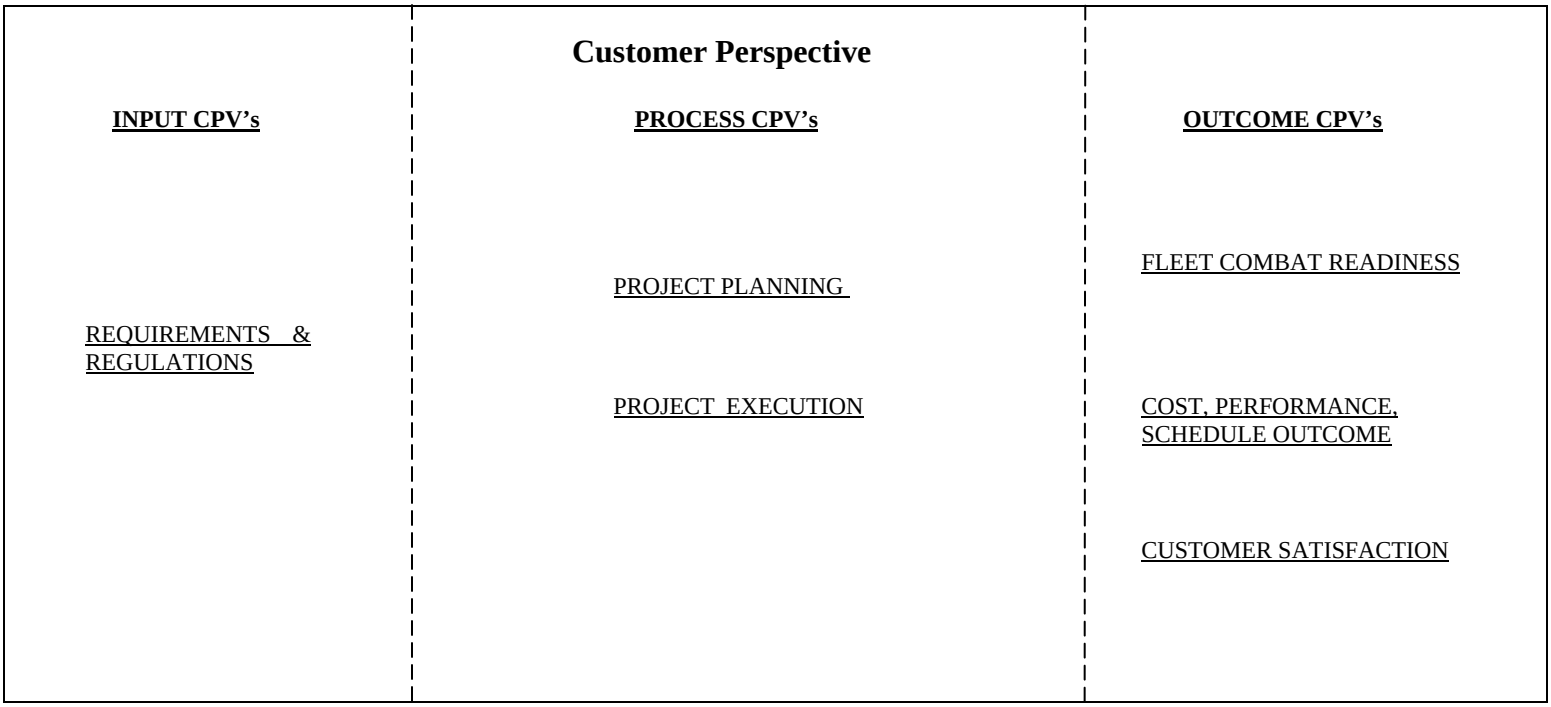

Figure 19. Customer Perspective CPV's

a. Fleet Requirements Input

Fleet requirements are the genesis of all work performed at PHD. These requirements can originate from an enlisted technician on a ship who recognizes a problem with a maintenance procedure, or from PEO IWS as a matter of the Navy's future direction. Regardless of the point of origination, these requirements can be stated as customer needs. In the author's opinion, awareness of customer needs is an area that should be within the span of control at PHD. Feedback and communications from the fleet, program sponsors, and other WC's should be used to raise and maintain this awareness.

b. Project Planning Process

PHD identifies three core functions as the critical value-generators within the organization. They are listed as follows:

- Installation – Install new or modernized warfare systems within cost and schedule limits, and meet quality standards.
- Test & Evaluation (T&E) – Determine valid criteria to test and evaluate/analyze weapon systems against established/stated performance/operational objectives.

- Support – Ensure continued operability, maintainability, capability, and reliability of in-service systems (NSWC PHD 2005).

Line managers indicated that program sponsors are primarily concerned with cost, schedule, performance, and readiness as they relate to the core functions described above. In terms of fleet customers, performance and readiness are the key expectations. Within the planning process, interviews indicated that meeting customer expectations requires early and accurate planning. This includes planning to meet future customer needs in a variety of aspects (e.g., logistics, E&T, T&E) (NSWC PHD 2005). Specifically concerning performance and readiness, interviews indicated that building reliability, maintainability, availability, and supportability factors into products and services is critical. This was emphasized as the only way to meet expected life-cycle cost and effectiveness goals. Line managers also emphasized that managing risk within project planning is essential to meeting customer safety needs.

c. Project Execution Process

Due to PHD's life-cycle responsibilities for products and services, the project execution process can continue for many years after fielding an installation, upgrade, or service. Line managers indicated that reliability, maintainability, availability, and supportability are the key components that determine how much involvement will be required by PHD to support customer needs over the life cycle of products and services. Interviews also indicated that PHD tracks project execution meticulously to assure customer's that expectations will be met.

d. Fleet Combat Readiness Outcome

Interviews indicated that achieving fleet combat readiness goals is the primary goal from the customer perspective. While this is linked closely with the cost, schedule, and performance outcome, line managers indicated that the bottom line goal is to enhance mission capability for the customer. This outcome links directly to PHD's strategic objective, "Improve Combat Systems Readiness."

e. Cost, Schedule, Performance Outcome

As stated within the project planning and execution processes, achievement of cost, schedule, and performance goals is one of the customer's primary

expectations. This outcome links directly to PHD's strategic objective, "Improve the Efficiency, Delivery and Quality of Our Products…Right Work at the Right Cost."

f. Customer Satisfaction Outcome

Interviews indicated that the customer satisfaction outcome is directly affected by the project planning and project execution processes, as well as successfully achieving fleet combat readiness and cost, schedule, performance goals. This outcome is also directly linked to PHD's strategic objective, "Improve the Efficiency, Delivery and Quality of Our Products…Right Work at the Right Cost."

4. Financial Perspective

Within the financial perspective at PHD, CPV's should address the question "To succeed financially, how should we appear to shareholders (Kaplan and Norton 1992)?" The CPV's within Figure 20 should answer this question. Shareholders in this context include the chain of command and providers of PHD's funded workload.

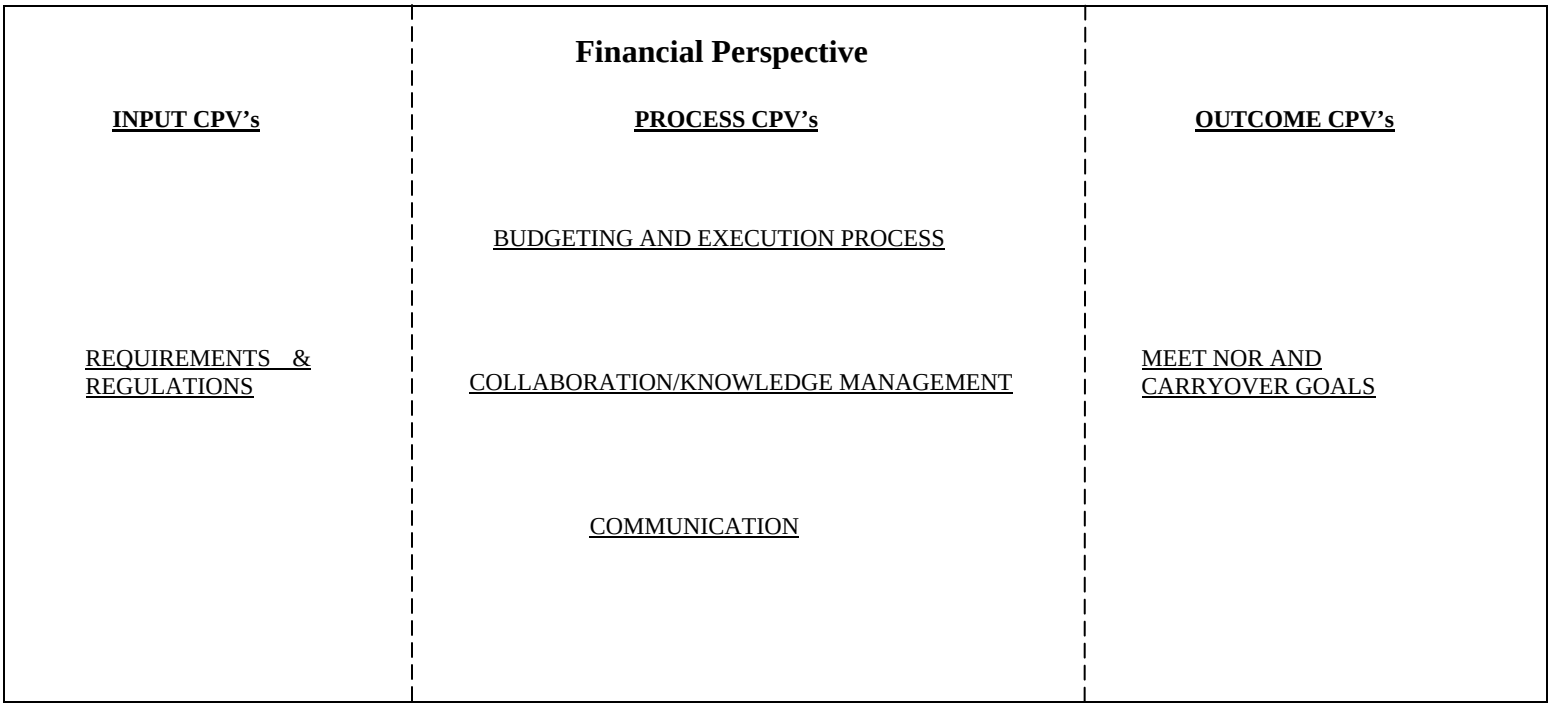

Figure 20. Financial Perspective CPV's

a. Financial Regulation Input

The financial operations at PHD largely fall under constraints of regulations for NWCF activities. PHD submits an A-11 Budget 18 months in advance of the budget year. The President's Budget, typically received in January, assigns the annual NOR goal for the execution year and the stabilized rates to be used in the following year. PHD officially receives an operating budget and budget authority through an "Annual Cost Authority" letter issued by NAVSEA. The only portion of this budgeting framework that is under the span of control at PHD is the original A-11 Budget submission. Since this submission likely changes after filtering through the President's Budget, metrics associated with the submission will likely provide little benefit. Achieving NOR is obviously critical from a compliancy standpoint, and should be monitored closely. (NSWC PHD 2005)

Customer funding regulation is a more complex area that requires additional management attention. PHD receives funding from customers (e.g., program sponsors, PEO's, fleet) on either a reimbursable or direct citation of funds basis. Reimbursable funds are only available for in-house work, including both direct labor and overhead. Funds received on a direct citation basis are available for contracting purposes only. This construct requires continuous management attention as direct hours, overhead, and the NOR goal must be in balance. (NSWC PHD 2005)

The carryover funding requirement is another NWCF item tracked extensively by everyone from NSWC Headquarters to Congress. Carryover funding includes all reimbursable funding that has not yet been costed (i.e., work performed or material/equipment received). Direct citation funds are not counted as part of carryover. If carryover is too high, Congress views the program as over funded. If carryover is not managed properly, the result could be cuts in program funding, which negatively affects the fleet combat readiness and customer satisfaction outcomes at PHD. (NSWC PHD 2005)

b. Budgeting and Execution Process

The budgeting and execution process at PHD is complex due to many dynamic variables that should always be in proper balance. The first component of this

complexity is managing the proportion of reimbursable work against contracted work executed. On the reimbursable side, the carryover measure safeguards "dumping" of funds by program sponsors to NWCF activities, claiming that funds have now been obligated. On the contractual side, NSWC Headquarters performs internal audits on all divisions to ensure that funded workloads are not executed simply by increasing contractual outlays (NSWC PHD 2005).

Interviews indicated that the real challenge in budgeting and execution lies in the balance among direct hours, overhead, and achievement of the NOR goal. If direct labor costs are greater than budgeted, overhead must go down to compensate for the finite amount of reimbursable funding. Also, if productive work hours decrease due to unforeseen circumstances (e.g., leave, command holidays, new federal holidays), overhead again must go down to compensate for a loss in productivity. The complexity of this balancing act increases due to the components of overhead, which range from human capital and training to facilities and utilities. The corporate business office feels this pressure also as overhead requirements rarely decrease, and services provided are directly affected by reductions in the amount of overhead that can be allocated.

Changes to the execution year budget exist outside of the unforeseen circumstances above. For the current execution year, fiscal year 2005, PHD was directed to change the NOR goal with less than five months remaining in the cycle (NSWC PHD 2005). This directly impacts reimbursable and direct citation funding, as well as direct hour and overhead allocation. Additionally, PHD was directed to expand a single stabilized rate to three pay bands of low, medium, and high stabilized rates. This was directed one month prior to the end of the fiscal year to align all division stabilized rates across NSWC (NSWC PHD 2005). This could directly affect customer satisfaction as new funding profiles may have to be negotiated. Furthermore, realized cost savings from Task Force Lean are a deviation from the budgeted plan, creating a need for further recalculations.

Specifically for overhead within corporate business, the consideration of established benchmarks can be difficult if those benchmarks are not readily available.

Until benchmarks are identified for overhead within core functions, it is the author's opinion that the corporate business office will likely have great difficulty in improving efficiency and effectiveness.

c. Communication and Collaboration Processes

As mentioned in Chapter IV, both the comptroller and corporate business offices rely heavily on communication and collaboration across WC's. Interviews indicated that standardized processes resulting from communication and collaboration encourage more productive efforts. This streamlines the budgeting and execution process across NSWC as management attention is placed where it matters most (NSWC PHD 2005).

d. Meeting NOR and Carryover Goals Outcome

Interviews indicated that meeting NOR and carryover are essential outcomes for success at PHD. Interviews also indicated that the intricacies within the financial regulations input and budgeting and execution process essentially boil down to achievement of these two outcomes. These outcomes link directly to PHD's strategic objective, "Operate as a Seamless Organization by Improving Enterprise Collaboration."

B. ASSESSMENT OF EXISTING PERFORMANCE METRICS AT PHD

This section assesses existing performance metrics at PHD and also provides recommendations for improvement as appropriate. Existing metrics are again organized by balanced scorecard perspective in an attempt to match the format of the assessment with that of the analysis. The author's perceptions of measurement processes at PHD were gathered from interviews and face-to-face discussions with line managers, as well as from documentation provided by PHD. Additionally, existing metrics listed in the following section were selected by the author based on line management emphasis throughout the research process. This will likely not be an all-inclusive list, but aims to capture the existing metrics that receive management attention.

The author precedes the assessment within each perspective with a table which illustrates existing metrics at PHD, the CPV's they attempt to capture, and suggestions for improvement. These suggestions are discussed in more detail within the assessments that follow.

1. Learning and Growth Perspective

Table 5 illustrates existing metrics at PHD, the CPV's they attempt to capture, and suggestions for improvement. Suggestions are discussed in more detail within the assessments that follow.

CPV	Existing Metric	Suggestions for Improvement
Human Capital Input	**Hiring Plan Achievement**	**None**
	Demographics	**None**
	Civilian End Strength	**None**
	Retention Rate %	**None**
	Full-Time Equivalents Reduced	**None**
Workforce Development Process	**DAWIA Certification %**	**None**
	IDP Accomplishment %	**None**
	# of Degrees/Certifications Achieved	**None**
	# of Awards & Recognition	**None**
	# of Mentoring/Rotational Participants	**None**
	# of Mandatory Training Hours	**None**
	GENESYS Survey	**For supplemental use only**
		Junior Professional progression and retention
Task Force Lean Process	**Time to Achieve Successful Personnel Redeployment**	**None**
		Redeployed work hours resulting from Lean events
		Realized vs. Estimated cost savings
		Lean metrics within SEAR for risk management
Communication and Collaboration Processes	**Number of Collaborative Projects**	**Change to actual collaboration vs. benchmark in "standardization plan"**
		Number of innovations and best business practices resulting from collaboration
Competent Workforce Outcome	**Workforce Reshaping Proportion**	**Refine by implementing a more comprehensive benchmark**

Table 5. Existing Metrics and Suggestions (Learning and Growth)

a. Human Capital Input

Based on data collected, an input metric for human capital within the learning and growth perspective at PHD should be useful. Looking back at the criteria established in Chapter II, an input metric should be appropriate since the cost of human capital is high and quality is important. Interview subjects indicated that skill sets, education, experience, and salary are critical variables within a hiring and attrition plan. Metrics associated with these variables are likely objective and complete, although limited in responsiveness due to hiring limitations and retirement uncertainties. Despite this limited responsiveness, an input metric using a hiring and attrition plan as a benchmark should provide PHD with insight as to how well they recruit people with the necessary skills to innovate and meet the challenges of the 21st century.

PHD implements a detailed hiring and attrition plan that includes input metrics (NSWC PHD 2005). The hiring plan identifies skill set needs and the status of hiring to meet those requirements. Attrition uncertainty is mitigated outside of this hiring plan by tracking civilian end strength within each department. Expected retirements, resignations, transfers, and other sources of attrition are meticulously tracked to ensure that requirements within the hiring plan are complete. Trend analyses are performed within demographic categories to ensure that PHD is aware of potential diversity challenges within the workforce (NSWC PHD 2005). These input metrics are likely as complete, objective, and responsive as possible for this CPV.

b. Workforce Development Process

Based on data collected, a process metric for workforce development should be useful for PHD. Applying process metric criteria, the author believes that many workforce development processes can be observed and measured, cost of measuring is low, and enhancements in the workforce can result in strategic advantage for PHD.

As illustrated in Table 6, PHD uses multiple process metrics to track the development of the workforce. An 85 percent Defense Acquisition Workforce Improvement Act (DAWIA) certification goal is utilized as a workforce standard based on federal requirements, with realistic training time requirements built in for personnel

shifting positions and responsibilities. PHD also uses IDP accomplishment percentage to ensure personnel are on track in meeting goals they have committed to. A process metric for the number of degrees and certifications is used to reflect how well the workforce is achieving higher education. To measure cross-functionality in the workforce, PHD measures the number of rotational participants across departments. Additionally, a mandatory training hour metric is utilized to reflect how well the workforce is receiving required knowledge to perform within their core competencies. (NSWC PHD 2005) In the author's opinion, these metrics are objective and responsive for the workforce development CPV. To be more complete, the author recommends including a process metric to measure the effectiveness of the JP program. Measuring the progression and retention of these junior engineers should provide valuable insight into how well PHD develops new human capital in accordance with their vision for future needs.

Documentation provided to the author indicates that PHD also uses surveys to measure workforce development. In 2003, NAVSEA contracted GENESYS Solutions, LLC to conduct an assessment of how well transformation initiatives are taking root in the organization. The survey is administered to employees within NAVSEA, including employees at PHD (Palmer 2004). Within this survey are workforce development metrics that capture employee perspectives on productivity, specifically addressing continuous improvement and the ability to change (GENESYS 2004). A numerical rating and color code is assigned based on the alignment of answers with the direction of transformation initiatives (Palmer 2004, GENESYS 2004). From the author's perspective, survey results are easy to read and provide a "ballpark feeling" for how well PHD is doing in workforce development. Trend and comparative analyses using these surveys can be useful to PHD management to supplement other process metrics. The surveys are objective in that they use NAVSEA strategy as a benchmark, and also complete in that data collected are quite comprehensive. However, the metrics within GENSYS surveys are not very responsive due to the annual nature of the assessment. The author believes that existing process metrics discussed in the previous paragraph are more leading in nature, and better sources of timely management information within the learning and growth perspective.

c. Task Force Lean Process

PHD uses the process metric "time to achieve successful personnel redeployment" to track the effectiveness of Task Force Lean events. In generic terms, this metric measures how long it takes to realize freed up capacity resulting from the elimination of process inefficiencies (NSWC PHD 2005). While this metric is objective, complete, and responsive, it also may be too costly to measure. To objectively capture the timeliness of Lean efficiencies, the author recommends a process metric that should be easier to measure, such as "redeployed work hours resulting from Lean events." This metric should require a shorter timeframe for measurement, since it is strictly results based. It also should reflect whether learning and capacity growth is actually occurring or not. To objectively capture the "successful" aspect of Lean efficiencies, the author recommends measuring the difference between estimated cost savings and realized cost savings. Since Lean has only been institutionalized at PHD since August 2004, results from the latter metric should just be coming into visibility.

Subjects interviewed also brought up the possibility that risk increases when process steps are eliminated, based on the assumption that some of these steps were created for a reason that may not be fully understood by the parties conducting the Lean event. The author recommends including Lean in the SEAR process to ensure risk is identified and mitigated appropriately. The SEAR process should provide leading, vice lagging, indications of increasing risk for Lean events. SEAR and risk management are addressed in more detail within the customer perspective.

d. Communication and Collaboration Processes

Measuring internal communication and collaboration could be challenging because these processes are not always observable and even if they are, they may be too costly to measure. However, since data collected indicates that communication and collaboration CPV's are essential to success at PHD, an effort should be made to identify processes that lend themselves to measurement.

PHD uses the process metric "number of collaborative projects" to measure the effectiveness of the collaboration process. This metric has no benchmark for comparison, which indicates to the author that cause-and-effect relationships are

determined subjectively. To better establish an objective measure, the author recommends establishing a "standardization plan" as a benchmark. Such a plan could standardize collaboration requirements and goals, among other things, to focus joint efforts on cause-and-effect relationships that matter. Based on interviews, the author believes there is sufficient tacit knowledge within line managers at PHD to identify internal and external collaboration requirements for standardization. In the author's opinion, being able to pinpoint such requirements is what learning and growth are all about. Instead of subjective relevance assessments, a standardized benchmark would afford PHD with the ability to measure collaboration objectively. This process metric would also be more complete and responsive than the existing relevance assessment methodology. In the author's opinion, the most challenging aspect of creating a process metric for collaboration would be the time investment required by line managers to identify the benchmark discussed here. In the author's opinion, the investment is worthwhile if a good process metric for collaboration is the result.

Specifically in terms of external communication and collaboration, the author also recommends a process metric for "the number of innovations and best business practices resulting from external collaborative efforts." This would measure the effects of formal collaboration with such agencies as industry, government laboratories, academia, other WC's, other PAD's, and so on. This process metric should provide an objective indication of how well external communication and collaboration creates value for the PHD enterprise. While this would likely be used as a lagging metric for trend analysis, it should be as objective, complete, and responsive as possible in terms of external collaboration.

e. Competent Workforce Outcome

In the author's opinion, an outcome metric should be used to capture effectiveness within the competent workforce area. This is due to the likelihood that such a metric should be easy to measure with a benchmark in place, measurement should not be costly, and process metrics may not provide a complete picture of performance to management.

PHD utilizes a "workforce reshaping proportion" process metric to indicate how well the workforce is shaped to meet future challenges. This outcome metric compares the percentage of the workforce that is composed of engineers and scientists to the percentage composed of administrative support (NSWC PHD 2005). While this measure is objective and responsive, the author recommends more fidelity in the required proportions to improve completeness. Stated differently, the author recommends a more comprehensive benchmark against which to measure the competent workforce. This benchmark can be found within PHD's Human Capital Process, illustrated in Figure 21 below. From the author's perspective, the "Understand Future Work" and "Analyze Workforce/Gap Analysis" components of this process are where the attributes for a competent workforce should originate from. PHD should be able to identify the skills required to address future technology development while meeting NSWC and Navy workload requirements. The "skills assessment" portion of the gap analysis is the outcome metric, using required skills as the benchmark. The actual outcome metric could be a percentage "fill-rate" of required skills, or the number and types of skills that must be hired or acquired to meet skill set needs.

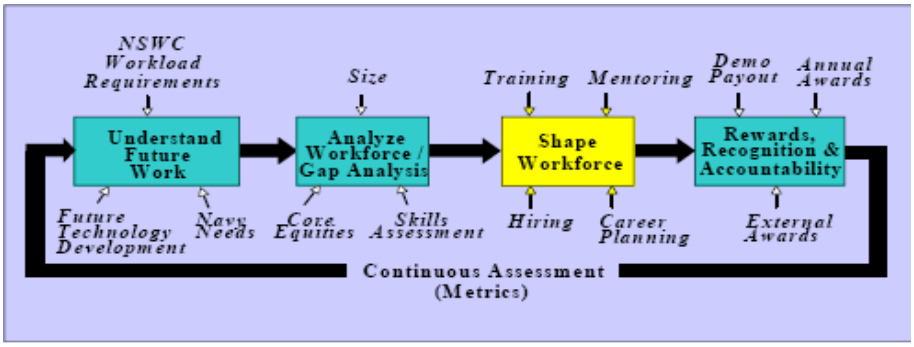

Figure 21. PHD Human Capital Process (NSWC PHD 2005)

2. Internal Business Processes Perspective

The internal business process perspective is by far the most complex standpoint as it encapsulates the core processes of project planning and project execution. Due to the nature of PHD's mission, these processes typically extend through the life-cycle of products and services. Table 6 illustrates existing metrics at PHD, the CPV's they attempt to capture, and suggestions for improvement within this perspective.

CPV	Existing Metric	Suggestions for Improvement
Requirements Input		number of requirements available on web portal vs. identified requirements
Project Planning Process	Number of Initiatives Input	Refine to "number of initiatives input that result in a fielded service or product"
		Percentage project planning compliance using IPT standard as benchmark
Project Execution Process	Earned Value Management System Budget vs. Execution	None
	% Objectives executed per Test Event	None
		% failed test objectives
	Contracting Efficiency	None
	Competitive Sourcing	None
	Return on Investment	None
		Percentage existing contracts under favorable CPARS/CSASS evaluations
Communication and Collaboration Processes	Integrated tests executed	None
	Number of Collaborative Projects	Actual collaboration vs. benchmark established in "standardization plan"
Task Force Lean Process	Training	None
	Cost Savings	None
Leadership and Oversight Process	Technical Warrant Holder Assessment	None
	GENESYS Survey	For supplemental use only
Standardized Processes Outcome	Number of Standardized Business Processes	None
	Environmental standard operating procedures	None
	Environmental Training	None
	Security	None
	Safety walk-about metrics	None
	Safety mishaps	None
	Travel card delinquencies	None
		Expand standardized compliancy metrics within overhead

Table 6. Existing Metrics and Suggestions(Internal Business Processes)

a. Requirements and Regulations Input

As discussed in the analysis of internal business processes, multiple different requirements and regulations feed into the operational processes at PHD. In the author's opinion, these inputs should be available in a standardized location to eliminate time wasted in searching for applicable regulations and requirements. The author recommends a knowledge management input metric to capture the accessibility and pervasiveness of these requirements and regulations throughout the PHD workforce. Due to the importance of safety and quality at PHD, an input metric should be useful. This metric could be the number of requirements and regulations available on the web portal in the numerator, with identified requirements and regulations in the denominator.

Due to the large scope of such a metric, the author recommends that identification of requirements and measurement of compliance be broken down at least to the department level. While the initial cost of identifying requirements and importing this data into the web portal may seem prohibitive, a systematic centralization of essential information should eliminate wasted resources for years to come. This metric would likely be as objective, complete, and responsive as possible. In the author's opinion, internal business requirements benchmarks should fit nicely into the standardization plan recommended within the learning and growth perspective.

b. Project Planning Process

The author assessed that PHD has one existing metric tied specifically to the project planning process within the internal business processes perspective. The "number of initiatives input" metric measures how well the organization is proactively planning compared to expectations and past performance. This metric is probably not complete because it does not measure the effectiveness of the initiatives. To implement a more complete metric, the author recommends revising this to "number of initiatives input that result in a fielded service or product." The same trend and comparative analyses can be conducted using this metric, as well as a measure of results versus goals.

Analysis of the project planning CPV indicated that PHD should excel at planning reliability, maintainability, availability, and supportability attributes into projects. A useful process metric for integration in project planning could be percentage

project planning compliance, using a defined integrated process team (IPT) standard as a benchmark. Such a metric should provide management with an awareness of how much tacit knowledge within the organization is being applied to a given project. Applying an IPT standard should also directly support the standardized processes outcome.

The author also recommends incorporation of a process metric for integration of stakeholders in the planning process. As suggested in the analysis section, a useful metric could be percentage project planning compliance, using an IPT as a benchmark.

c. Project Execution Process

Interviews indicated that departments at PHD utilize EVMS to track the progression of cost, performance, and schedule within contractor management systems. The American National Standards Institute and DOD both require use of this tool, validating the process metrics it produces (DOD 2003).

In terms of test and evaluation project execution, PHD utilizes "percentage test objectives executed per test event" to measure both efficiency and effectiveness. The author feels this metric is objective, complete, and responsive in terms of executing to a test plan. A useful process metric that could feed back into the planning process could be the "percentage test objectives that failed within the test plan." A trend analysis of this metric could indicate to management how well test plans are generated in the planning process.

PHD also utilizes a "Return on Investment" (ROI) metric to capture an equivalent monetary value created by projects and initiatives. PHD utilizes the Jack Phillips (Phillips 2005) methodology, where ROI is calculated as illustrated in Figure 22. While this is a true ROI measure with revenue in the numerator and cost in the denominator, the cost of equating a monetary value to a project or initiative could be prohibitive. The author was also made aware that an "NSWC Investment Board" is standardizing the methodology for ROI measurements across all six divisions (NSWC PHD 2005). In the interim, the author recommends that PHD continue to apply ROI measurements if equating projects and initiatives to a monetary value is not too costly. In terms of ROI, this should be as objective, complete, and responsive as possible.

$$\frac{Monetary\ value\ of\ project - Cost\ of\ project}{Cost\ of\ project}$$

Figure 22. ROI Methodology (Phillips 2005, NSWC PHD 2005)

d. Contracting Process

PHD utilizes process metrics to measure how well they are performing in terms of competitive sourcing. One metric utilized measures how many cases have been reviewed in the fiscal year, which provides a trend analysis over time to indicate the level of effort required to stay abreast of contracting requirements (NSWC PHD 2005). Another metric is cost savings resulting from competitive sourcing practices (NSWC PHD 2005). In terms of competitive sourcing, the author believes these process metrics are objective, complete, and responsive.

In terms of contracting efficiency, PHD also utilizes a process metric to measure the average days it takes to award contracts (NSWC PHD 2005). While this is a good efficiency metric, the author recommends incorporating additional process metrics that measures effectiveness. There are two systems within NAVSEA that can assist PHD in achieving this. The Contractor Performance Assessment Rating System (CPARS) is a web tool that provides an automated library of contractor performance evaluations on systems and non-systems contracts (NAVSEA 2005). The Construction Contractor Appraisal Support System (CCASS) is another web tool that provides an automated library of construction contract performance (NAVSEA 2005). A useful metric for contract effectiveness could be the percentage of existing contracts that are under contractors with favorable CPARS or CCASS evaluations.

e. Leadership and Oversight, Communication, and Collaboration Processes

PHD performs "technical warrant holder assessments" to ensure they are exercising due diligence in their responsibilities under delegated technical authority (NSWC PHD 2005). This leadership and oversight process metric measures percentage completion of assessment to ensure required oversight is on track. This metric is objective, complete, and responsive for this specific area of leadership and oversight. The author recommends that PHD further include process metrics to measure systematic

interfacing between line managers and subordinates. One such metric could be the number of corrective actions required by line managers with regard to subordinates. This metric, while potentially sensitive, could reveal where oversight is most necessary, while also encouraging subordinates to do work right the first time.

To measure the communication and collaboration processes, PHD again uses a relevance assessment of the "number of collaborative projects." As discussed within the learning and growth perspective, the author feels this is a subjective measure. The author recommends a standardization plan to provide a benchmark against which communication and collaboration efforts can be objectively measured. This would likely be as complete and responsive as possible.

The GENESYS survey provides a wealth of annual metrics with the leadership and oversight, communication, and collaboration processes. As stated earlier, the author feels this is good supplemental information, but not timely enough to gauge the dynamic nature of these processes. The author recommends use of these data only as a supplement to the metrics discussed above.

In the test and evaluation arena, PHD utilizes a "number of integrated tests executed" process metric to measure the extent of communication and collaboration. This is analyzed in a trend analysis, under a results versus goals framework. The author feels this metric is objective, complete, and responsive for collaborative test and evaluation.

f. Task Force Lean Process

Among the metrics utilized within the Lean program, interviews emphasized cost savings as the most important to line managers. Training of personnel ranked second. The author views outcome metrics tied to these as objective, complete, and responsive from the internal business process perspective. For Lean to be pervasive at PHD, personnel must be trained. For the program to be effective, cost savings must be realized. These two critical components of Lean are captured in the process metrics utilized.

g. Standardized Processes Outcome

PHD lists the number one metric in this area as the "number of standardized business processes," analyzed as results versus goals (NSWC PHD 2005). The author agrees with this emphasis, and recommends further objectivity by establishing the recommended standardization plan.

Many compliancy-focused outcome metrics are also utilized at PHD within the standardized processes outcome. Each of the departments reports on environmental, safety, and security status in the standardized metrics listed in Table 7 (NSWC PHD 2005). The author recommends expanding this list of standardized metrics to other overhead components tracked by the corporate business office. This would ensure that outcome metrics are not only objective and responsive, but also complete.

3. Customer Perspective

The customer perspective is centered on fleet combat readiness, customer satisfaction, and cost, schedule, performance outcomes. Table 7 illustrates existing metrics at PHD, the CPV's they attempt to capture, and suggestions for improvement within this perspective. Suggestions are discussed in more detail within the assessments that follow.

a. Requirements Input

During interviews, line managers frequently emphasized the importance of understanding current requirements. As discussed in the analysis section, awareness of requirements, or customer needs, is an area that should be within the span of control at PHD. Following Chapter II criteria, an input metric should be useful to PHD since safety and quality are important from the customer perspective. The author recommends an input metric for capturing how well PHD receives feedback and requirements from different stakeholders (e.g., test and evaluation, acquisition, contracting, procurement, overhead). For ease of measurement, the author recommends using this metric for a trend analysis of the quantity of information received from different customers, indicating how well PHD is staying abreast of current issues.

CPV	Existing Metric	Suggestions for Improvement
Requirements Input		**Quantity of feedback and requirements received from stakeholders**
Fleet Combat Readiness Outcome **Cost, Schedule, Performance Outcome** **Project Planning Process Project Execution Process**	**Probability of Capability** **(1 – probability of mission failure without equipment reliability failure, computer reliability failure, or human error)**	**None**
	Probability of Personnel Capability (1 – probability of mission failure due to human factors)	**None**
	Reliability (Mean Time Between Failures)	**None**
	Maintainability (Mean Time to Repair)	**None**
	Supportability (Mean Logistics Delay Time/ Mean Logistics Time, Time to Assign Support, Time to Close Issue, Support avenues, Distance Support cost avoidance)	**Include average time to assign support, average time to close issue, and Distance Support cost avoidance within SEAR**
		Percentage avenues utilized for support
		Average cycle time between deploying engineers and gaining them back within departments
	Affordability (PHD program costs, P_p cost, A_o cost)	**None**
	Safety (mishap risk assessment values)	**None**
Fleet Combat Readiness Outcome	**Operational Availability** **Uptime/(Uptime+Downtime)**	**Incorporate NAVICP "mean time between demand" into reliability metrics**
Customer Satisfaction Outcome	**Operational Availability**	**None**
	Customer surveys - **Task Environment Survey** - **GENESYS**	**For supplemental use only**

Table 7. Existing Metrics and Suggestions (Customer Perspective)

b. Project Planning and Project Execution Processes

Interviews and documentation indicate that PHD uses process metrics within periodic SEAR reviews to ensure products and services support the fleet combat readiness, customer satisfaction, and cost, schedule, performance outcomes (NSWC PHD 2003, 2005). In terms of safety, PHD uses "mishap risk assessment values" to identify safety risks within individual and integrated equipments, systems, or platforms (NSWC PHD 2003). Figure 23 illustrates the categories of risk for PHD. If a red or yellow risk is identified, an execution plan is required to identify the risk to personnel or equipment, steps taken to reduce risks, and a specific timeframe for risk mitigation (NSWC PHD 2003). In the author's opinion, the systematic review of safety within the SEAR is objective, complete, and responsive.

SEVERITY PROBABILITY	CATASTROPHIC	CRITICAL	MARGINAL	NEGLIGIBLE
FREQUENT	1	3	7	13
PROBABLE	2	5	9	16
OCCASIONAL	4	6	11	18
REMOTE	8	10	14	19
IMPROBABLE	12	15	17	20

Mishap Risk Assessment Value	Mishap Risk Category
1 – 5	High (Red)
6 – 9	Serious (Red)
10 – 17	Medium (Yellow)
18 – 20	Low (Green)

Figure 23. PHD Risk Assessment Framework (NSWC PHD 2003)

Effectiveness, or performance, is captured within the SEAR using a variety of process metrics. The Capability of Performance (P_c) metric is defined as the capability to perform a given mission. P_c is an empirical wrap-up of many sub-probabilities, including such probabilities as radar detection, weapon system engagement, homing, missile guidance, or warhead damaging or killing the target (NSWC PHD 2003). P_c is also applied to non-weapons systems, such as the underway replenishment system developed by PHD to transfer cargo, ammunition, and fuel between ships at sea (NSWC

PHD 2003). This metric is used in a comparative framework with requirement and performance documents that state design and operating parameters necessary to achieve specific missions (NSWC PHD 2003). As such, P_c is objective and responsive within the project planning and execution processes. This process metric provides the customer with readiness and assurance that performance requirements are met. However, P_c does not provide a complete picture of performance. To better establish completeness, other process metrics are necessary to account for human factor failures, reliability, maintainability, and supportability.

Since P_c does not take human factor failures into account, PHD utilizes the P_p metric to capture these factors. P_p is the probability of humans performing all of the necessary steps on time to properly set up and operate one or more systems and complete the mission (NSWC PHD 2003). Quantitative data for manning levels, the breakdown of a sailor's workday, and scheduled and unscheduled maintenance are used in conjunction with more subjective experiential data to approximate P_p. These data are collected primarily from fleet training authorities and PHD interaction with the fleet during Combined Combat System Qualification Trials (CSSQT) and Combat Systems Assessments (CSA) (NSWC PHD 2003, 2005). CSSQT's and CSA's provide PHD engineers and scientists with a hands-on opportunity to observe how systems and sailors interface in an operational environment (NSWC PHD 2005). In the author's opinion, data collected and analysis performed to approximate P_p are as objective, complete, and responsive as possible.

Interviews indicated that reliability, maintainability, and supportability factors should be incorporated into project planning to ensure PHD builds in attributes that support the highest achievable performance standards during project execution (NSWC PHD 2005). In the author's opinion, PHD systematically utilizes process metrics within the SEAR to capture the drivers behind reliability and maintainability. The top driver for reliability is mean time between failures (MTBF), which is identified and tracked within the SEAR. Also identified and tracked is the mean time to repair (MTTR), which provides an indication of maintainability by measuring the average

corrective maintenance time required to correct a failure. In the author's opinion, these process metrics are objective, complete, and responsive within both the project planning and execution processes.

In terms of supportability within the SEAR, PHD uses mean logistics delay time (MLDT) metrics to measure how long the fleet waits to receive demand parts (NSWC PHD 2003). While this is an objective and responsive metric, the author feels other process metrics incorporated into the SEAR are necessary for completeness. Such metrics are already in existence at PHD, but are not incorporated in the SEAR. The author recommends inclusion of "average time to assign support," "average time to close issue," and "Distance Support cost avoidance" metrics. Additionally, a trend analysis of "percentage avenues utilized for support" (e.g., phone, e-mail, naval message, assist visit) should provide a different, more complete view of supportability within the SEAR (NSWC PHD 2005). The author further recommends a process metric for the average cycle time between deploying engineers for assist visits and receiving them back within departments. This should provide PHD with a productivity measure for the cost of face-to-face supportability.

A_o, or operational availability, is a metric that indicates how often a system is available to the user when called upon. As a process metric, A_o is a target that must be designed to and executed in order to support fleet requirements. As an outcome metric, A_o is an indicator of actual readiness in the fleet. A_o is defined as follows:

$$A_o = \frac{MTBM}{MTBM + MDT} = \frac{uptime}{uptime + downtime} \text{ (Blanchard 1991)}$$

The reliability, maintainability, and supportability process metrics utilized by PHD directly feed into A_o. MTBF, the primary driver of reliability, is the unscheduled portion of mean time between maintenance (MTBM) (Blanchard 1991). MTTR and MLDT are components of mean downtime (MDT) (NSWC PHD 2003). In the author's opinion, the SEAR program does an outstanding job of tracking key metrics that indicate how well systems should perform, and the impact on fleet combat readiness.

PHD defines affordability as the relationship of safe and effective metrics to cost. Since PHD is an agent for the program sponsor and an advocate for the fleet, they are in a unique position to collect and analyze metrics, perspectives, and initiatives for both customers (NSWC PHD 2003). PHD measures PHD program costs, P_p cost, A_o cost, and cost avoidance and savings initiatives to provide a complete customer perspective of affordability (NSWC PHD 2003). In the author's opinion, these metrics are objective, complete, and responsive for cost from the customer's perspective.

In the author's opinion, the metrics existing within the SEAR coupled with recommended supportability metrics should provide customers with a clear window into the project planning and project execution processes at PHD. These metrics should be presentable in whatever venue is chosen, whether it be a program review, supportability review, or fleet readiness review. In the author's opinion, the only danger is erroneous data input into these metrics, which should be mitigated through frequent reviews and timely communication with stakeholders.

c. Communication and Collaboration Processes

As stated in the analysis, the author believes communication between PHD and project stakeholders is essential. For external projects with program sponsors and the fleet, the author recommends a process metric to capture the cycle time from receipt of stakeholder feedback in the planning process to communication through the chain of command. For internal projects, the author recommends a process metric to capture the cycle time from identification of internal projects to communication of direction and intent to employee stakeholders.

d. Fleet Combat Readiness Outcome

Improved Combat Systems Readiness is an overarching strategic objective for PHD (NSWC PHD 2005). For customers, outcome metrics for A_o, reliability, maintainability, and supportability should provide an indication of how well PHD creates value. Interviews indicated that PHD tracks these metrics very closely to ensure that they are indeed creating value. In the author's opinion, the challenge at the outcome stage is the latency of data inputs for these metrics. Interviews indicated that it takes about nine months worth of data collection to yield reliable statistics at Corona Division (NSWC

PHD 2005). PHD collaborates with Corona to gain visibility into data at the earliest possible point, but there may be methods to supplement these data in a more timely fashion. In terms of part support, it is the author's experience that the fleet will often request parts needed without transmitting an official Casualty Report (CASREP). A more timely outcome measure could be the "mean time between demand" for parts that NAVICP tracks. In general terms, the author recommends using sources closer to the fleet to gain more timely insight into fleet readiness data.

e. Customer Satisfaction and Cost, Schedule, Performance Outcomes

PHD utilizes surveys to determine how satisfied customers are with the value that PHD creates. The Task Environment Survey (TES) was conducted four times since 1991 on primary end-users of PHD products and services to determine the customer level of satisfaction (NSWC PHD 2005). NAVSEA is moving away from TES towards a new corporate survey approach that will impact the fleet less (NSWC PHD 2005). The GENESYS survey, conducted on an annual basis, provides an internally-focused, NAVSEA customer perspective on the level of satisfaction. These surveys, although useful, are likely limited due to aggregated data and infrequent observations that make findings challenging to respond to.

In the author's opinion, PHD should use the project planning and execution metrics mentioned in the previous section to discern customer satisfaction. The only difference should be a focus on actual results versus requirements, rather than expected results versus requirements. While this may seem fairly obvious, the process and outcome metrics are likely two distinct perspectives that the customer has when considering the value of PHD.

4. FINANCIAL PERSPECTIVE

Table 8 illustrates existing metrics at PHD, the CPV's they attempt to capture, and suggestions for improvement within this perspective. Suggestions are discussed in more detail within the assessments that follow.

CPV	Existing Metric	Suggestions for Improvement
Budgeting and Execution Process	**Business Base/ Reimbursable/Direct Cite Funding**	**None**
	NOR/Carryover	**None**
	Direct Hours	**None**
	Overhead Hours	**None**
	Attrition	**None**
	Civilian/Military End Strength	**None**
	Civilian/Military Productive Workyear	**None**
	Productivity Ratio	**None**
	Overhead Cost	**None**
	Military Labor Cost	**None**
	Overhead Training Hours	**None**
	Direct Training Hours	**None**
	Overhead as Percentage of Total Cost by NSWC Division	**None**
		None
Task Force Lean Process	**Cost Savings**	**None**

Table 8. Existing Metrics and Suggestions (Financial Perspective)

a. Financial Regulations Input

As discussed in the analysis, the changing nature and lack of control over budget constraints do not lend themselves to easy and accurate measurement. Although financial regulations establish the boundaries within which PHD can operate, the cost of measuring an input metric would likely outweigh the benefit received. The author does not recommend implementing a financial regulations input metric.

b. Budgeting and Execution Process

In the author's opinion, PHD has the necessary financial process metrics in place to ensure success within comptroller functions and NWCF constraints. PHD has existing process metrics in place for reimbursable funding, direct citation funding, NOR progress, carryover progress, and the major categories of overhead. Based on interviews with line managers, it is clear to the author that these metrics are pervasive throughout the organization, and tracked with great frequency and accuracy. These metrics are lagging

as they provide a snapshot of events that have already occurred, but are also leading as they provide information on the likelihood of meeting future financial goals. Additionally, there is a balance of financial and non-financial metrics, as overhead components such as productive workyears, end strength, attrition, productivity, and training hours are measured. These process metrics are assessed as objective, complete, and responsive for the comptroller office.

As discussed in Chapter IV, the office of corporate business deals with overhead. Interviews indicated that this office uses the existing metrics in Table 6 in a fashion similar to the comptroller. However, the author believes they should have more detailed metrics to capture effectiveness within each of the overhead activities they supervise within PHD. Interviews indicated that this is especially challenging for corporate business due to a lack of benchmarks in areas such as information technology, facilities maintenance, training hours, or utilities. The author recommends a knowledge management metric to assist the budgeting and execution process within the office of corporate business. This process metric could be the number of benchmarks identified in the numerator, and the number of overhead activities in the denominator. This metric should be easy to measure with a low associated cost. This metric should support the criticality of standardization within corporate business, and set them on the right track to improving effectiveness and efficiency. While objective and responsive, this measure is not complete as it does not directly support the lack of visibility in detailed overhead activities. This process metric should establish a foundation on which to build detailed visibility through more accurate overhead metrics.

c. Communication and Collaboration Processes

In the author's opinion, a process metric for collaboration under the financial perspective would likely provide little useful information to management. Interviews indicated that the financial community within the NSWC enterprise communicates and collaborates very frequently with good results. The author believes establishing standardized collaboration requirements within the financial perspective

would be too difficult because the budgeting environment appears very dynamic. The cost of measuring and difficulty in observing cause-and-effect relationships discourages utilization of a process metric.

d. Meet NOR and Carryover Goals Outcome

Due to the dynamic nature of the processes that determine this outcome, it is likely more useful to measure NOR and carryover through the components of the budgeting and execution process. An outcome metric would be lagging in nature while the process metric provides both lagging and leading indications from the financial perspective.

VI. ALIGNMENT OF PHD WITH FEDERAL GUIDANCE

The intent of the following chapter is to assess PHD performance measurement in a comparative framework with the federal guidance discussed in Chapter III. The approach used in this assessment is a one-on-one comparison between PHD and agencies in the chain of command. The assessment begins with NSWC Headquarters, and progresses upward through the President's Management Agenda (PMA).

To help ensure this comparison is objective, the author selected the strategic objectives or key elements of performance measurement within each agency and assesses PHD's performance within that context. The intent is to highlight the overarching themes and assess how well PHD aligns within those themes.

A. NSWC HEADQUARTERS

The March 2005 NSWC Concept of Operations (CONOPS) document details strategic objectives for NSWC. Figure 24 illustrates the linkage between these objectives and the strategic objectives of PHD.

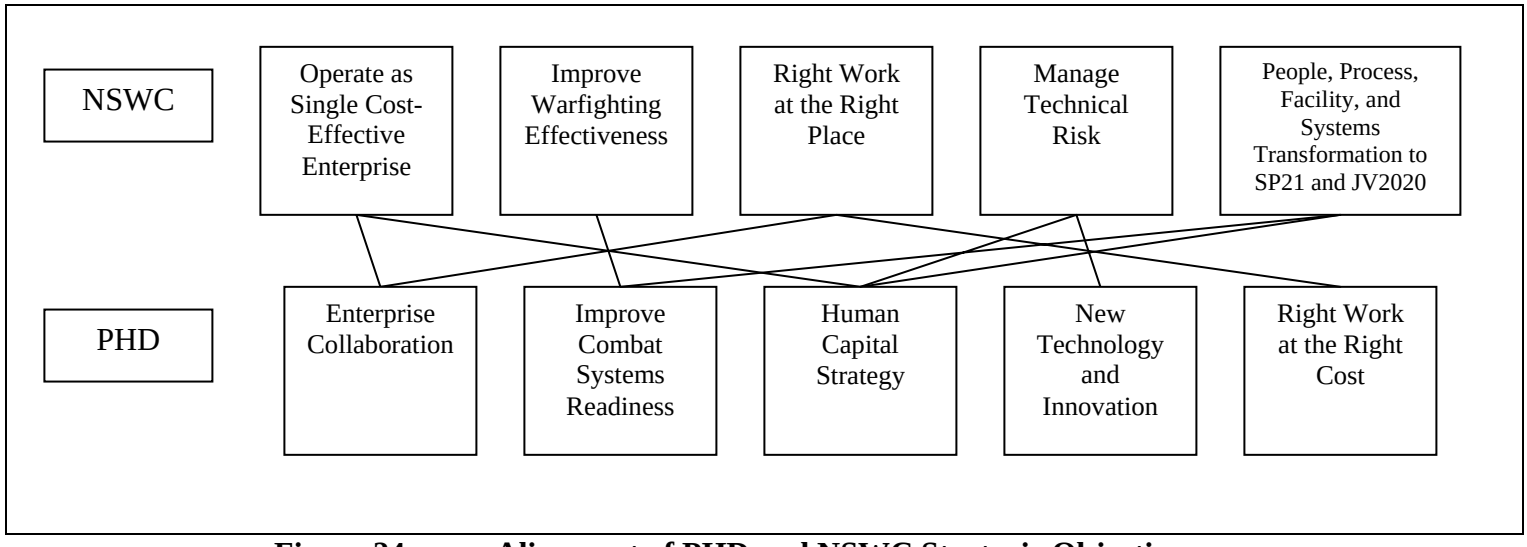

Figure 24. Alignment of PHD and NSWC Strategic Objectives

In the author's opinion, PHD is aligned very well with the strategic objectives of NSWC. In terms of operating as a single cost-effective enterprise, PHD's "enterprise collaboration" objective is strikingly similar. Analysis and assessment reveals that PHD places great emphasis on the collaboration process CPV. This collaboration is dependent on human capital elements, as illustrated with the link to the human capital strategic objective above. Within this objective, NSWC also desires that divisions have a metrics-driven, ROI-focused approach within the single cost-effective enterprise objective (NSWC 2005). From data collected it is clear to the author that PHD uses metrics routinely, while striving for constant improvement. Additionally, PHD uses an ROI-focused approach within the internal business processes perspective as detailed earlier in Chapter V.

NSWC's "improve warfighting effectiveness" strategic objective and PHD's "improve combat systems readiness" strategic objective are also strikingly similar. PHD's rigorous SEAR program incorporates objective, complete, and responsive measures for effectiveness. Line managers indicated that improving readiness is their primary goal within the customer perspective.

In the author's opinion, PHD directly supports the "right work at the right place" objective for NSWC. The only difference between this objective and PHD's "right work at the right cost" objective is the fact that NSWC has the span of control to decide which division is most appropriate for accomplishment of work, while PHD only has the ability to decide what department or contractor will perform the work. Other than this difference, the author sees the objectives as virtually identical. PHD's "enterprise collaboration" objective also supports NSWC by ensuring visibility into options and trade-offs through open communication and collaboration. This communication and collaboration emphasis is firmly established within the analysis and assessment of PHD CPV's.

As indicated by technical warrant holder assessments, focus on execution of due diligence, and oversight of technical authority, PHD also aligns with NSWC's "manage technical risk" objective. The link to human capital strategy stems from the workforce

development process at PHD that ensures a competent workforce safeguards technical authority. The link to technology and innovation stems from SEAR risk management embedded in PHD projects.

Lastly, PHD is also aligned with NSWC's objective for Sea Power 21 and Joint Vision 2020 transformation. Interviews indicated that in-service engineering initiatives and technical development within the project planning and execution processes are conducted in step with the vision of Navy leadership. PHD's human capital strategy also provides a detailed shaping plan for the workforce to meet future challenges, further supporting this objective.

B. NAVSEA

The NAVSEA guidance for 2005 details strategic objectives for the organization. Figure 25 illustrates the linkage between these objectives and the strategic objectives of PHD.

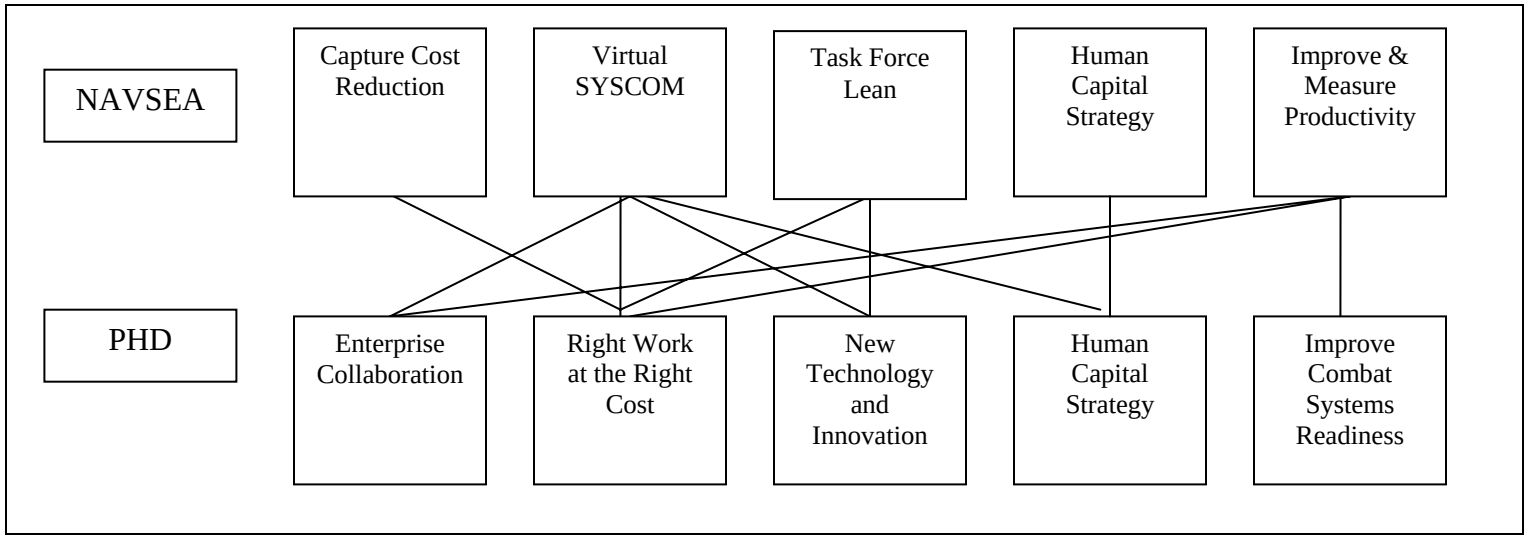

Figure 25. Alignment of PHD and NAVSEA Strategic Objectives

As evidenced in the analysis and assessment sections of this chapter, PHD emphasizes affordability and cost savings in many process and outcome CPV's. Task Force Lean, EVMS, the SEAR program, and competitive sourcing are examples of this. From this it is the author's opinion that PHD is aligned with NAVSEA in "capture cost

reduction" and "Task Force Lean" objectives. This linkage is illustrated above in PHD's "…right work at the right cost" objective.

The second objective concerns the Virtual SYSCOM. A brief description of the Virtual SYSCOM follows. The Virtual SYSCOM is a partnership among NAVSEA, NAVAIR, Space and Naval Warfare Systems Command, Naval Supply Systems Command, and Naval Facilities Engineering Command. This partnership works to transform business processes and enhance the delivery of products and services at reduced costs. Significant goals include increasing productivity, accelerating the process of innovation, collaborating across functional communities, and shaping human capital strategy. (Virtual SYSCOM 2005) These goals are recurring themes within process CPV's discussed in the analysis and assessment section. PHD aligns with the Virtual SYSCOM objective through "enterprise collaboration," "…right work at the right cost," and "new technology and innovation" objectives.

In the author's opinion, PHD is not as well aligned in terms of measuring and increasing productivity. This is not to say that PHD is lacking in productivity, but rather that a limited number of existing productivity measures are in use at PHD. This is an area that is receiving increased management attention due to the Virtual SYSCOM focus (NSWC PHD 2005). However, to achieve alignment with the "measure and improve productivity" objective additional work needs to be accomplished.

Lastly, the author believes that PHD is well aligned in terms of human capital strategy. PHD and NAVSEA have the common vision of structuring and shaping a workforce that is responsive to the needs of the Navy and Marine Corps warfighter (NAVSEA 2005, NSWC PHD 2005). Evidence of this is found in the detailed hiring and attrition plan at PHD, human capital metrics, and line management emphasis on the criticality of new hiring decisions.

C. CNO

The CNO guidance for 2006 details strategic objectives for the Navy. Figure 26 illustrates linkage of these objectives to the strategic objectives of PHD.

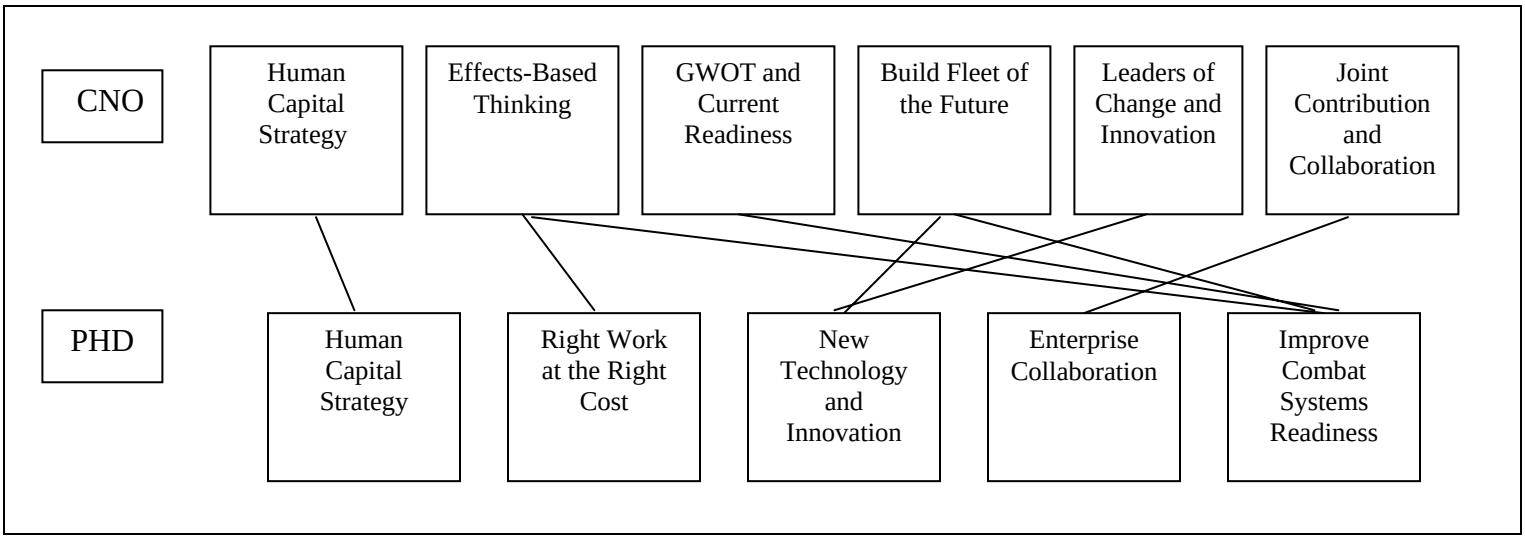

Figure 26. Alignment of PHD and CNO Strategic Objectives

In terms of human capital strategy the CNO is forward-looking, stating as his objective to "determine and deliver on the Navy's future force structure requirements (CNO 2005)." PHD is aligned with this human capital strategy, as evidenced by line manager emphasis on identifying emerging technologies and matching hiring decisions to those technologies. Within human capital strategy, the CNO also desires that technical authority be assessed and improved (CNO 2005). PHD's focus on due diligence, technical authority oversight, and technical warrant holder assessments are further evidence of alignment with this objective.

In terms of effects-based thinking, the author believes PHD is very well aligned. The CNO desires that executive management be institutionalized in effects-based thinking (CNO 2005). It is clear to the author that line management is well-versed in this mentality. Line managers place significant emphasis on outcomes, and process CPV's that determine outcomes over the life-cycle of products and services. Furthermore, PHD's strategic objectives "improve the efficiency, delivery and quality of our products…right work at the right cost" and "improve combat systems readiness" directly support an effects-based mentality in the author's opinion.

The CNO's objective to support the Global War on Terrorism (GWOT) and current readiness is well aligned with PHD's objective of improving combat systems readiness. This is PHD's primary customer-focused outcome. Additionally, the CNO's

objective to build the fleet of the future and be leaders of change and innovation is aligned with PHD's "embrace new technology and develop a culture of innovation" objective. The underlying CPV's discussed in the learning and growth perspective indicate that line managers embrace change and consistently work toward achieving these outcomes.

In terms of joint force contribution and collaboration, the author feels that PHD is somewhat limited do to a primarily Navy focus. However, it is clear to the author from data collected that internal and external collaboration is embedded in PHD and continues to grow. In the author's opinion, this meets the intent of the CNO's vision to contribute and collaborate as much as possible.

D. SECNAV AND FMB

Figure 27 illustrates the Secretary's strategic enablers for military effectiveness. A discussion of PHD's alignment with these enablers and performance measurement within FMB follows.

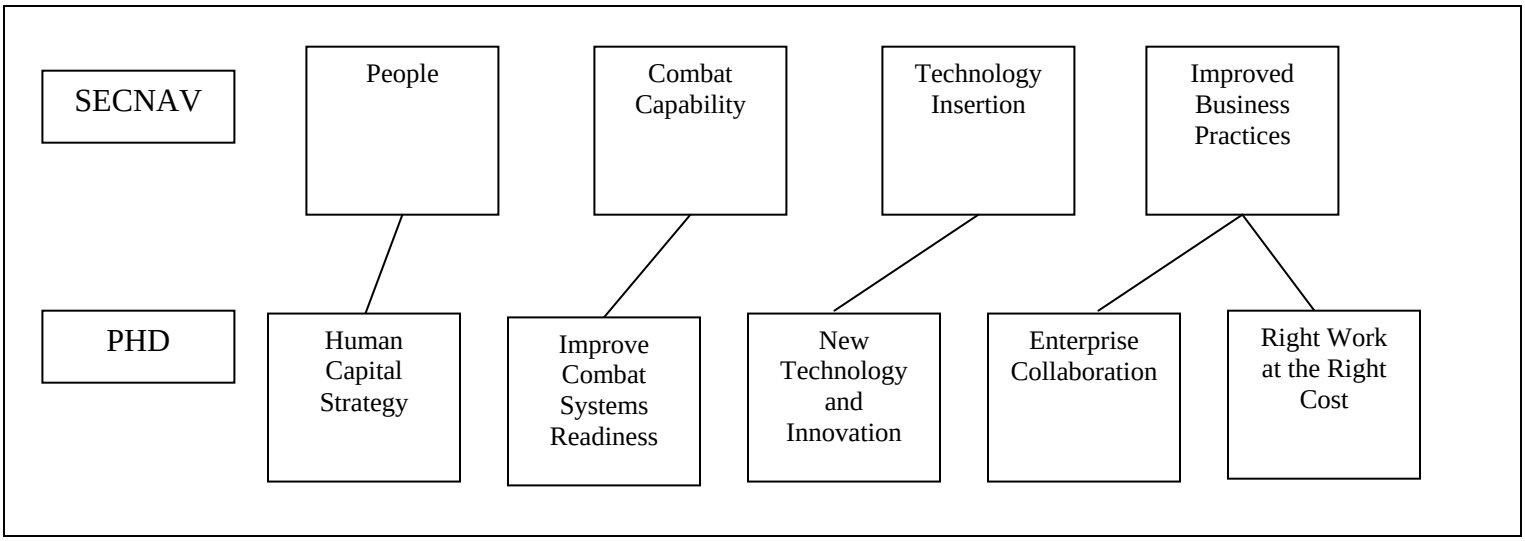

Figure 27. Alignment of PHD and SECNAV Strategic Enablers

As illustrated above, it is clear that the strategic objectives at PHD are linked to the strategic enablers of the Secretary. In terms of people, the Secretary's primary goals are to shape the 21st century workforce, improve training and development, and streamline and align manpower (FMB 2005). From the data collected, it is clear to the author that each of these goals is supported within PHD's human capital strategy. Data

collected indicate that the human capital input, workforce development process, and competent workforce outcome CPV's capture the goals within this objective.

In terms of combat capability, the Secretary's primary goals are executing GWOT, executing the fleet response plan, and maintaining forward seabasing (FMB 2005). These goals indicate a focus on current readiness to the author. As demonstrated in the analysis and assessment sections, line managers emphasize many components of current readiness in the project execution process, which leads to the fleet combat readiness outcome. In the author's opinion, PHD is in alignment with this enabler.

The Secretary's primary goals for technology insertion are accelerated investment to recapitalize, an emphasis on system survivability, and a robust and balanced R&D effort. Data collected indicate that PHD focuses on system survivability from the beginning of the project planning process. The analysis and assessment indicated that PHD conducts R&D within a balanced framework. While these indicate sound alignment with the Secretary's enabler, the author does not have data indicating alignment with accelerated investment for recapitalization.

Specific goals within the improved business practices enabler are improved productivity, supporting the BRAC process, and achievement of facility support goals. As stated in the assessment of alignment with NAVSEA, the author does not believe PHD is well aligned with measuring improved productivity due to limited productivity metrics in place. However, the institutionalization of the Lean CPV throughout PHD should eventually yield such productivity metrics. In the author's opinion, PHD falls too far down in the chain of command to align with the "supporting the BRAC process" and "achievement of facility support" goals. However, in general terms data collected indicate that PHD is very much aligned with improved business practices. Two powerful examples are the distance support and SEAR programs, which directly result in both fleet combat readiness and cost savings.

As discussed in Chapter III, DOD's balanced scorecard aligns strategy, goals, objectives, and related performance metrics within the Risk Management Framework established in the QDR and MID 901. Within the Navy, Major Commands derive their

own specific balanced scorecards within this Risk Management Framework, and align their vision, goals, objectives, and metrics with balanced scorecard perspectives (Carpenter 2005). It is clear to the author that PHD strategically plans and measures performance in accordance with this Navy practice. In April 2005, PHD conducted a "Vision, Mission, Strategy" session that identified each of the components of the planning and measurement process. While a balanced scorecard was not implemented for the command, the assessment of existing metrics indicates that balanced measurement is in effect at PHD. Data collected also indicates that PHD links metrics to their strategic objectives. This indicates alignment with the basic performance measurement practices within the Navy.

In the author's opinion, FMB is focused primarily on budget and performance integration in the area of performance measurement. Evidence of this is found in the FY 2006/2007 Department of the Navy Budget, where matching of resources with metrics is highlighted on numerous occasions (FMB 2005). This should be no surprise as great emphasis is placed on this area within the GPRA, PMA, and PART evaluation. In the opinion of the author, PHD does an excellent job of matching budget and performance data. As discussed within the financial perspective at PHD, both financial and non-financial measures are used to meticulously track execution of the funded workload. These metrics can be broken down by department or further by project. In the opinion of the author, the precision of this performance measurement process in terms of budget and performance integration is optimal. Coupling financial metrics with process and outcome metrics in other perspectives could provide even more fidelity. The author assesses PHD's alignment with Navy and FMB performance measurement practices as effective.

E. DOD

As discussed in Chapter III, DOD narrows the performance measurement focus down to four or five leading outcomes within each risk area in the Risk Management Framework. These outcomes must be tied to strategy, quantifiable, measurable over time, relevant to establish an objective level of performance, and tied to specific measures in line organizations to drive behavior (DOD 2005). In terms of this general performance measurement approach by DOD, the author believes that PHD is well

aligned. Data collected indicate that the predominance of metrics at PHD are objective, complete, and responsive. Furthermore, each existing input, process, or outcome metric is quantifiable and measurable over time. Alignment of PHD with DOD's focus on PART and PMA improvements is revealed in the following two sections.

F. OFFICE OF MANAGEMENT AND BUDGET

As discussed in Chapter III, OMB established PPA's and the PART evaluation to aggressively inquire whether GPRA standards are met within the program, placing emphasis on outcome, output, and efficiency measures. While PHD is not at the program level and will not receive an actual PART evaluation, the criteria within the PART is nonetheless applicable to PHD. Funding for work at PHD originates primarily from customers at the program level, so adherence to PART criteria should only reinforce the alignment of those program sponsors to PART evaluations and PPA's that will occur sometime in the near future.

The following assessment is broken down into the four aspects of program performance within the PART. A figure listing PART questions within each aspect precedes the author's assessment of PHD alignment with PART intent. The author's assessment is based on data collected from documents, interviews, and discussions during the course of research.

PROGRAM PURPOSE AND DESIGN

Question 1.1: Is the program purpose clear?

Question 1.2: Does the program address a specific and existing problem, interest, or need?

Question 1.3: Is the program designed so that it is not redundant or duplicative of any other Federal, State, local or private effort?

Question 1.4: Is the program design free of major flaws that would limit the program's effectiveness or efficiency?

Question 1.5: Is the program design effectively targeted so that resources will address the program's purpose directly and will reach intended beneficiaries?

Figure 28. PART Program Purpose and Design Questions

1. Program Purpose and Design

In the author's opinion, PHD meets the intent of the program purpose and design section within the PART. Data collected demonstrate that PHD clearly articulates the mission, vision, values, and strategic objectives for the organization. Documentation revealed that this direction is communicated command-wide immediately upon agreeing on such direction (NSWC PHD 2005).

PHD addresses the specific and existing need to integrate, test, evaluate, and provide life cycle engineering and logistics for surface warfare systems (NSWC PHD 2005). No other division within NSWC, or in the Navy for that matter, has the in-service engineering responsibilities or technical warrants for surface warfare systems that PHD holds. Divisions within NSWC do not compete with one another for work, as they all serve a specific purpose for the Navy (NSWC PHD 2005).

Lastly, data collected indicate that PHD regularly meets strategic objectives and performance goals (NSWC PHD 2005). Results from process and outcome metrics indicate that intended beneficiaries (fleet and program sponsors) are receiving the quality of products and level of services expected (NSWC PHD 2005). In the author's opinion there is no strong evidence that another approach or mechanism would be more efficient or effective to achieve the intended purpose of appropriations for PHD.

STRATEGIC PLANNING

Question 2.1: Does the program have a limited number of specific long-term performance measures that focus on outcomes and meaningfully reflect the purpose of the program?

Question 2.2: Does the program have ambitious targets and timeframes for its long-term measures?

Question 2.3: Does the program have a limited number of specific annual performance measures that can demonstrate progress toward achieving the program's long-term goals?

Question 2.4: Does the program have baselines and ambitious targets for its annual measures?

Question 2.5: Do all partners (including grantees, sub-grantees, contractors, cost-sharing partners, and other government partners) commit to and work toward the annual and/or long-term goals of the program?

Question 2.6: Are independent evaluations of sufficient scope and quality conducted on a regular basis or as needed to support program improvements and evaluate effectiveness and relevance to the problem, interest, or need?

Question 2.7: Are Budget requests explicitly tied to accomplishment of the annual and long-term performance goals, and are the resource needs presented in a complete and transparent manner in the program's budget?

Question 2.8: Has the program taken meaningful steps to correct its strategic planning deficiencies?

Figure 29. PART Strategic Planning Questions

2. Strategic Planning

In terms of strategic planning, the author assesses PHD as aligned with the intent of the PART. Data collected indicate that PHD uses a limited amount of outcome measures that are each linked to strategic objectives. These outcome metrics are long-term in nature due to the life-cycle focus of PHD in the operations and support phase of the acquisition cycle. Furthermore, it is clear to the author that PHD is focused on continuous improvement as evidenced in the SEAR, Task Force Lean, and Distance Support programs. Each of these programs is associated with ambitious targets and timeframes within a strategic planning process (NSWC PHD 2005).

In the author's assessment, PHD has sufficient metrics in place to demonstrate progress towards achieving long-term goals. Data collected indicate that PHD has leading metrics within each of the balanced scorecard perspectives. PHD also satisfies the PART minimum requirement for one efficiency metric, satisfying this with multiple efficiency metrics within the financial and internal business process perspectives. The requirement for R&D organizations to track how the program could improve scientific understanding and its application is satisfied with outcome metrics in the learning and growth perspective and internal business processes perspective.

Data collected indicate that PHD ties performance goals very closely to budget submissions. This is reinforced by internal audits by line managers, as well as external program reviews. It is also clear to the author that PHD is increasing the focus on strategic planning through formal venues (e.g., leadership council, performance measurement awards submissions). (NSWC PHD 2005)

The author does not have sufficient information to determine the extent to which all partners (e.g., contractors, cost-sharing partners, other government programs) are working toward the long-term goals of the program. Based on an increasing business base and upward trends in almost every metric, the author would believe the answer to be yes, but no clear evidence obtained in research validates this belief.

Program Management

Question 3.1: Does the agency regularly collect timely and credible performance information, including information from key program partners, and use it to manage the program and improve performance?

Question 3.2: Are Federal managers and program partners (including grantees, sub-grantees, contractors, cost-sharing partners, and other government partners) held accountable for cost, schedule and performance results?

Question 3.3: Are funds (Federal and partners') obligated in a timely manner and spent for the intended purpose?

Question 3.4: Does the program have procedures (e.g., competitive sourcing/cost comparisons, IT improvements, appropriate incentives) to measure and achieve efficiencies and cost effectiveness in program execution?

Question 3.5: Does the program collaborate and coordinate effectively with related programs?

Question 3.6: Does the program use strong financial management practices?

Question 3.7: Has the program taken meaningful steps to address its management deficiencies?

Figure 30. PART Program Management Questions

3. Program Management

The author assesses that PHD is strongly aligned with the intent of the program management section of the PART. Data collected clearly indicates to the author that PHD excels at financial management practices and obligating funds in a timely manner for the intended purpose. Metrics within the financial perspective are very objective, complete, and responsive to financial and non-financial dynamics that change on a daily basis. Data collected also indicate that PHD collaborates internally and externally to support outcome CPV's and realize cost savings.

As previously discussed, PHD has metrics in place for such areas as competitive sourcing, contract efficiency, Lean cost savings, and combat systems effectiveness. These metrics are evidence of PHD's ability to measure and achieve efficiencies and cost effectiveness in program execution.

PROGRAM RESULTS/ACCOUNTABILITY

Question 4.1: Has the program demonstrated adequate progress in achieving its long-term performance goals?

Question 4.2: Does the program (including program partners) achieve its annual performance goals?

Question 4.3: Does the program demonstrate improved efficiencies or cost effectiveness in achieving program goals each year?

Question 4.4: Does the performance of this program compare favorably to other programs, including government, private, etc., with similar purpose and goals?

Question 4.5: Do independent evaluations of sufficient scope and quality indicate that the program is effective and achieving results?

Figure 31. PART Program Results/Accountability Questions

4. Program Results/Accountability

In terms of this section of the PART, the author is not able to assess actual results achieved and accountability at PHD due to the scope of this thesis. However, the author assesses that objective, complete, and responsive metrics are in place for PHD to gain

visibility into achievement of long-term performance goals. Furthermore, the author believes that input, process, and outcome CPV's are emphasized sufficiently by line managers, which should lead to improved efficiencies and cost effectiveness over time. Thus, existing metrics at PHD are assessed as effective in providing the necessary information to answer the questions above.

G. PRESIDENT'S MANAGEMENT AGENDA

The overarching goal of the PMA is to achieve "immediate, concrete, and measurable results in the near term" in five specific government-wide goals. The first of these goals is "Strategic Management of Human Capital (OMB 2001)." The President expects agencies to determine core competencies and execute a human capital strategy that is linked to the mission, vision, core values, goals, and objectives of the organization (OMB 2001). Within this context, the author believes that PHD is well-aligned. During an April 2005 "Vision, Mission, Strategy Session (VMSS)," PHD articulated a new mission statement, vision, core values, strategic objectives, and goals for the command. From each interview conducted it was clear to the author that the human capital input, workforce development process, and competent workforce outcomes were pervasive as CPV's throughout the organization. This pervasiveness is reinforced by the causal performance maps in Chapter IV. In Chapter V, it is clear to the author that PHD associates performance metrics to human capital and aligns these metrics with the "Develop and Reward Our Workforce" strategic objective. Furthermore, human capital metrics are pervasive within the learning and growth, financial, and internal business processes perspectives in Chapter V.

The second goal of the PMA is "Competitive Sourcing." The goal of the administration is to regularly examine commercial activities performed by government, promote competition through increased participation in OMB Circular A-76 initiatives, and objectively identify the most efficient means to accomplish tasks whether by the government or the commercial sector (OMB 2001). In objective terms, PHD has a "competition advocate" and Contract Strategy Review Board that are responsible for compliance with federal regulations such as competitive sourcing. One of the items that the board reviews is competitive sourcing metrics, which indicate how many contracts

have been reviewed for compliance, and the resulting cost savings from the competitive sourcing process. The author believes this is a good example of effects-based thinking, as well as sufficient evidence of alignment between PHD and this goal of the PMA.

The third goal of the PMA is "Improved Financial Management." The President desires achievement of a clean financial audit and the ability to produce accurate and timely financial information (OMB 2001). In the author's opinion, PHD is well-aligned with this goal in terms of comptroller functions. Within the NWCF balancing act, major aspects of direct costs and overhead are tracked systematically with both leading and lagging performance metrics. This information has to be timely due to the unexpected changes discussed in Chapter IV. Based on the author's observations it is clear that existing metrics for aggregate data are very timely.

However, the PMA also calls for improved financial systems to measure and affect performance immediately (OMB 2001). Based on interviews, it is clear to the author that the financial systems at PHD do not capture many details within overhead functions. This may be due primarily to a lack of identified benchmarks for certain overhead functions. In the author's opinion, the real dilemma is there is no "one-stop shop" where detailed overhead metrics can be measured and tracked for immediate visibility. The implementation of the C-ERP system within the next five years should resolve this dilemma. Until a better information management system is in place, detailed measurement of overhead will not likely be in alignment with the PMA.

The fourth goal of the PMA is "Expanded Electronic Government." The President desires a reduction in the expense and difficulty of doing business with the government, as well as a reduction in government costs (OMB 2001). In the author's opinion, PHD is a champion of this goal. PHD pioneered the Distance Support program, which allows direct and immediate electronic interface between PHD engineers and the fleet customer. This system reduces resources dedicated to travel, reduces productive time lost for engineers at PHD, and reduces downtime of equipment and systems, translating to increased operational availability. The author feels this is an adequate illustration of good alignment between PHD and the PMA.

The final goal of the PMA is "Budget and Performance Integration." The President desires better performance measures within agencies, use of performance information for program management, and integration of performance measures with budget submissions (OMB 2001). In the author's opinion, the SEAR program aligns PHD with this goal. The SEAR incorporates robust measures of performance within both the planning and execution process, and links these performance metrics to cost. This provides excellent budget integration information for not only PHD, but also program managers during their program reviews. In the author's assessment, the SEAR, EVMS techniques, and straight-line budget-execution metrics directly support program sponsors in the attainment of this PMA goal.

VII. CONCLUSIONS

A. EXISTING METRICS

Within this thesis, the author assessed 55 existing metrics that PHD uses to determine how well they are doing within CPV's. Other metrics are also in existence at PHD, but the 55 assessed are the metrics that, based upon this research, receive the majority of management attention. While these data may indicate to the reader that PHD is trying to track too many variables, the author does not believe this to be the case. Capturing the complex components and interaction among CPV's with only a few metrics is simply not realistic. However, if existing metrics are considered within each of the balanced scorecard perspectives, and also the appropriate level of the command hierarchy, then they should be manageable. In the author's opinion, the key to effectively managing existing metrics lies in continual improvement of internal collaboration and use of standardized business processes. All indications are that PHD is realizing this continual improvement.

PHD is doing a great job at measuring performance. The metrics in place at PHD are linked to strategy and capture how well they are doing in terms of the CPV's that determine their success. PHD maintains an excellent balance within their organization as demonstrated by an almost equal number of metrics tied to CPV's within each balanced scorecard perspective. There is also an excellent balance in the number of input, process, and outcome metrics used at PHD. Furthermore, the majority of existing metrics are objective, complete, and responsive. While the author makes suggestions for improvement, most of these are simple refinements to enhance objectivity, completeness, and responsiveness of existing metrics. Research did not reveal any serious gaps or deficiencies, but rather reinforced the adequacy of the performance measurement system in place.

B. ALIGNMENT WITH FEDERAL GUIDANCE

In terms of alignment with federal guidance, the author assesses that PHD is also doing very well. For a unit level command such as PHD, it is striking to the author how many of the overarching federal performance measurement goals are directly supported

by PHD. There is strong evidence of alignment with the PMA, as PHD directly supports and measures performance in each of the President's five goals. This is also true in comparison with OMB guidance. In the author's assessment, PHD could answer "yes" to almost every portion of the PART evaluation. This provides solid support for program managers, who fund work at PHD, to also align with OMB guidance. For the Navy and FMB, PHD is very well-aligned in the area of budget and performance integration. Strong financial and non-financial performance measures in the comptroller's office, coupled with the focused measurement in the SEAR program, result in a complete and transparent picture of value created by PHD. This is the type of outcome that supports the Navy's progression towards achieving clean financial statements, matching metrics to appropriations, and achieving efficiencies across the board.

PHD is also well-aligned within their immediate chain of command. As illustrated in Chapter VI, there is a strong linkage between strategic objectives at PHD and the strategic objectives of commanders upward in the chain of command. Since PHD links metrics to their strategic objectives, PHD's performance measurement system also reinforces the objectives of their superiors. It is again striking to the author how clearly the strategy of PHD matches the strategy of those higher in the chain of command. It is clear to the author that PHD is part of a common vision for the future of the Navy.

C. POTENTIAL FOR FUTURE RESEARCH

The methodology utilized in this thesis to create causal performance maps, identify and analyze CPV's, and assess existing metrics can be valuable for any organization that needs an overarching assessment of their performance measurement system. Since this thesis serves as such an overarching assessment, there are many additional opportunities for research building on the findings contained herein. Additional research questions include the following:

- Are PHD's existing metrics coupled with information technology to optimize effectiveness and efficiency?
- Are digital dashboards used by management within PHD appropriate and effective?

- How is ROI best determined for the different elements within an R&D intensive organization?
- How would effective productivity metrics be defined for PHD?

Fiscal constraints within government are a reality that will likely continue over the long term. This fact, coupled with the existing emphasis on federal performance measurement, places a continuing focus on improving effectiveness and efficiency. Further research in the subject area of performance measurement should prove useful for the Navy's leaders in meeting the challenges that lie ahead.

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