QUANTITATIVE EXPENDITURE DEVIATION COMPARISON BASED ON CANADIAN NAVY LOGISTICS OFFICER QUALIFICATION RESULTS AND TYPE OF MILITARY OPERATION

by

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ABSTRACT

The Royal Canadian Navy employs Logistics Officers at sea, who possess a financial management specialty; financial resources are accounted and managed by Naval Logistics Officers in Her Majesty's Canadian Ships. The annual, deployed, financial expenditures, managed by Naval Logistics Officers, have consistently deviated from planned mission allocations for maritime units deployed on international operations. The problem is that even though there are programs in place to train Naval Logistics Officer on the use of financial resources, it appears that there is a lack of accurate operational fund management. The purpose of this quantitative, non-experimental, ex post facto research study was to compare the differences between financial expenditure deviations within Her Majesty's Canadian Ships (HMCS), based on Royal Canadian Navy Logistics Officer Qualification Board results attained between 2000 and 2010, categorized by the nature of Canada's military operations in Afghanistan (OPERATIONS APOLLO, ALTAIR, or SAIPH) between 2000 and 2010. Findings presented in this study demonstrate that there is statistically no difference in mean RCNLOQB score and financial deviation. However, based on observed differences, RCNLOQB results were found to have a statistically significant effect on financial expenditure deviation within Her Majesty's Canadian Ships that deployed in US-led military operations with multiple nations compared to HMC ships that deployed in operations with only the US or in multinational campaigns. The effects of qualitative subjective factors were not included in this study and require further research to determine their degree of influence on financial management performance outcomes.

DEDICATION

I dedicate this study to my five children, Alexander Jacob, Avery, Angelica, Adam, and Arese Mensah, as a tribute to their tireless passion for reading, exploration, and youthful adventure. It was amazing to watch them grow with me along the journey of completing this dissertation, and for me to be regularly re-energized through their innocence and love of learning. It is my sincere hope that this contribution to building new knowledge inspires them to reach for their future dreams, and to never self-limit their true and extraordinary potential based on fear of the unknown, or perceived difficulty associated with realizing a goal.

The cultivated fruits of one's labors, were once the whispers of their wishful dreams.

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I would like to recognize the support of my dissertation committee. A brilliant group of professors tirelessly dedicated to my personal success. Thank you Dr. Jean R. Perlman and Dr. Sandy Kolberg for your support, encouragement, and precise feedback. You are wonderful leaders, scholars, and mentors. I am extremely fortunate to have benefitted from your experience and expertise. Dr. Holly Rick, I am grateful to you for your participation in my committee. I could not have completed this journey without you. To my dissertation chair, Dr. Jules (Jay) Klagge, you have been an absolutely inspiring mentor, scholar, and friend. Despite all the challenges of life that we experienced along this journey including my operational military deployment to Afghanistan, you never abandoned me. You never tired of my questions, and patiently worked alongside me to develop solutions. You are a gracious gentleman, and it has been both a pleasure and honor to have been mentored by such a tremendous individual.

Finally, I offer my deepest gratitude to my family. To my wife Diane, thank you for being such a steadfast supporter of my dream. Your care, consideration, and concern for our children and me have been the glue that has held us all together throughout this journey. Thank you for understanding the late nights, early mornings, and weekends spent sequestered away in front of my computer screen. This dissertation could never have been completed without your support. You will always hold a place of deep and profound love in my heart. I also offer my sincere thanks to my children who graciously understood that *daddy* could not always come out and play. I hope that they always appreciate the value of learning and look back upon this dissertation as a positive and important achievement in our life story.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

Introduction

Poole's ex post facto study (2007) assessed a gap in the Department of Defense (DoD) joint professional military education system that produced an inability for officers to consistently improve operational effectiveness based on attained qualifications since 1958. Performance-Based Logistics (PBL), implemented by DoD, was arranged into a systematic code of logistics performance measurement in 2001 as the optimal procurement strategy for effective financial resource management (Hutchinson, 2011; Quick, 2011); however, Quick (2011) determined that the system and its prescriptive training program did not produce expected efficiencies in weapon system acquisition valuing $600B between 2007 and 2009. Canadian and European foreign policies have been influenced and generally aligned with the United States (Byers, 2003). PBL is a philosophical support construct within the Department of National Defence (DND). Effective professional development programs are intended to increase individual competencies to produce desired results.

The Royal Canadian Navy (RCN) has experienced challenges in the translation of the Canada First Defence Strategy into precise procurement guidance for tactical-level logisticians, which has resulted in inflated bids, over-expenditures, remedial corporate remuneration, and vendor repayment schedule subsidization (Military Technology, 2006; Sanders, 2010). The RCN's Joint Support Ship project was intended to amalgamate some of the Command and Control capabilities of the current Tribal class destroyer fleet, and some of the replenishment capabilities of the Auxiliary Oil Replenishment class vessels, at a budgeted $1.72 billion. DND received proposals from ThyssenKrupp

Marine Systems Canada Inc., and SNC Lavalin ProFac Inc. DND subsequently cancelled the initial project bid solicitation because of suspected industry collusion when the competing proposals both returned $660.8 million expected budget shortfalls (AMI International Inc., 2008). Hansen (2010) discussed the critical importance for well-trained, and operationally focused Logistics Officers within the RCN. As the primary stakeholders for public-fund management within Her Majesty's Canadian ships, well-trained Logistics Officers are expected to demonstrate their technical knowledge through accurate management abilities. The unique and isolated nature of financial resource management in the maritime operating environment reinforces the advantage of producing self-sufficient RCN Logistics Officers who can effectively interact with private industry to produce cost-effective business solutions through the expenditure of public funds. The scope of financial resource management competencies gained by proficient Logistics Officers can be transferred to departmental and national procurement programs. Appropriately selected, well-trained RCN Logistics Officers develop individual, operational-support skills and abilities to devise and implement complex expenditure, acquisition and sustainment plans for current and future projects (Stolovitch, Keeps & Okros, 1990).

Background of the Problem

Logistical support and coordination of capital projects in the RCN have been adversely effected by frequent shifts in political priorities and the organization's inability to quickly and progressively initiate complex support plans in a consistent and responsive manner (AMI International, 2008; Kovessy, 2009; Pugliese, 2008). The process by which Logistics Officers translate strategic intent into tactical procurement and operational

support plans through the management of financial resources has the most appreciable effect in expeditionary, international military operations (Kim, Sheehy & Lenhardt, 2005; Taylor & Della-Moretta III, 2007). RCN Logistics Officers are solely responsible for the management of both public and non-public funds on board Her Majesty's Canadian Ships. Reliable training and professional development programs for RCN Logistics Officers establishes the learning framework for skills transfer that will determine the quality of future budgetary decisions. Time, energy, and financial resource commitments directed at competency and skills development, indicate expected organizational return on investment in the form of skill amelioration influenced by targeted performance enhancement training programs. Skills learned in the training environment are practiced during domestic and international military exercises. Applied repetitive skill demonstrations are progressively refined to realize predictable operational financial management business decisions. The breadth of external factors that influence ship-specific business decisions cannot be completely isolated to enable sterile expenditure determinations. RCN Logistics Officers apply learned skills to resource management problems through a systematic problem analysis and resolution methodology. RCN Logistics Officers are certified to perform the functions and assume the duties of Logistics Officers on board Her Majesty's Canadian Ships (HMCS) following successful completion of the Royal Canadian Navy Logistics Officer Qualification Board (RCNLOQB). Academic standing on the board has been subjectively assumed to be a predictor for expected performance outcomes during operational engagement at sea by the RCN Logistics leadership community. The enduring, traditionally presumed effect of RCNLOQB results on job performance has not been previously studied to validate this

cultural assumption. A correlation may exist between RCNLOQB results and financial deviation outcomes, however, such a correlation has not previously been studied nor has the difference between annual financial historical reports based on RCNLOQB results been quantified to provide useful decision-making information. The complexity of military operations should also be considered as a potential contributing factor to financial deviations.

Despite possessing a standardized qualification, attained following an explicit and prescribed training progression program, Royal Canadian Navy Logistics Officers deployed in support of Canadian maritime forces have experienced inconsistent degrees of financial success when managing operational budgets, and conducting operational support planning. Badea and Petrişor (2012) who discussed the systems approach to solving military logistics problems found that progressive operational support training positively effected expected performance outcomes and increased skill proficiency and consistency. Given the structured and iterative nature of training deductive decision-making strategies in military organizations, Badea and Petrişor posited that military logisticians would produce reliable results based on a common, systems thinking, and problem solving approach.

Statement of the Problem

The Royal Canadian Navy employs officers at sea, who possess a public accounting officer specialty. Financial resources are accounted and managed by Royal Canadian Navy Logistics Officers in Her Majesty's Canadian Ships (Department of National Defence, 2007; Jaques, 1986; Sanders, 2010). The annual, deployed, financial expenditures, managed by RCN Logistics Officers, have consistently deviated from

planned mission allocations for maritime units deployed on international operations (AMI International Inc., 2008). The general problem is, there is a lack of accurate operational and capital fund management that is seriously impeding the Canadian Force's ability to support Government of Canada requirements (Hartfiel, 2010). Since 2003, defense planners within the Department of National Defence have experienced significant challenges in converting strategic political guidance into tangible defense assets due to inconsistent financial management performance, which has impacted capital asset management proficiency in a number of defense platforms (Hartfiel, 2010). According to Hartfiel (2010), the Canadian Forces' lack of financial planning and management ability has increased incremental costs and resulted in acquisition delays that have been compounded by a requirement to concurrently lifecycle a greater percentage of the organizational capital assets. The RCN has developed a comprehensive training program to certify RCN Logistics Officers to perform operational support functions, including operational, public fund management in HMC ships, through the RCNLOQB. The structure and design of the RCNLOQB has been developed to improve job performance results. RCNLOQB results have not been objectively studied to determine their influence on differences observed in financial management performance. A study to increase external validity beyond para-military organizations by focusing on the framework upon which the professional development plans are based to improve financial management, could expand upon this proposed study and examine any effect of training results based on differences observed in performance measures from other business areas.

Purpose of the Study

The purpose of this quantitative, non-experimental, ex post facto research study (Ary, Jacobs & Razavieh, 1972; Chapin & Stryker, 1950; Galfo & Miller, 1970; Isaac & Michael, 1971) was to compare the differences between financial expenditure deviations within Her Majesty's Canadian Ships (HMCS), based on Royal Canadian Navy Logistics Officer Qualification Board results attained between 2000 and 2010. Expenditure deviation and board result pairs were categorized by the nature of Canada's military operations in Afghanistan (Operations APOLLO, ALTAIR, or SAIPH) between 2000 and 2010. The final reported financial position (surplus/deficit), of operational ships that have deployed in support of Canada's military operations in Afghanistan (Operations APOLLO, ALTAIR, or SAIPH) between 2000 and 2010, indicated the financial management deviation (dependent variable). The historical Royal Canadian Navy Logistics Officer Qualification Board results of 200 Canadian Forces personnel (independent variables), determined through the central limit theorem, comprised of 100% of Royal Canadian Navy Logistics Officers between the ranks of Lieutenant (Navy) and Commander, was studied. The difference between annual historical financial reports, based on RCNLOQB results was correlated and then comparatively analyzed based on the operational nature of the sampled HMC ship's deployment (independent variable). Historical, HMC ship's financial deviations from 2000 and 2010 were compared to determine differences based on Royal Canadian Navy Logistics Officer Qualification Board results. The differences between the deviations found in historical, annual, operational financial reports, based on the nature of military deployments, and RCNLOQB results were examined in this study. The use of existing data through the

proposed ex post facto study enabled a non-experimental, comparative, evaluation of differences in historical financial deviations of the three couplets of operations (e.g. ALTAIR to APOLLO, ALTAIR to SAIPH, and APOLLO to SAIPH). Although observed findings indicated differences in RCNLOQB scores and financial deviation pairs that are specific to different types of missions. The resulting analysis does not indicate trends useful for predicting future financial deviations based on RCNLOQB results in specific operational categories.

Significance of the Study

National defense organizations annually expend a significant proportion of taxpayer funds. In Her Majesty's Canadian Ships, Royal Canadian Navy Logistics Officers are solely responsible for the management and accountability of financial resources. The unique nature of this responsibility necessitates well-defined training systems that produce reliable and predictable outcomes. When funds are not effectively managed, the lack of financial planning accuracy removes flexibility from governments to otherwise allocate potentially available resources towards other important government activities. This study is significant to increase effective financial management among the leaders within the Department of National Defence, thereby reducing the loss of taxpayer funds. Results from this study will be useful in assisting organizational leaders to determine training resource commitments to achieve desired outputs by examining the difference in financial management performance outcomes based on training results, realized through comparative study.

Nature of the Study

The research was a quantitative ex post facto study. The study was focused on the differences between financial expenditure deviations within Her Majesty's Canadian Ships that have deployed in support of Canada's military operations in Afghanistan on Operations APOLLO, ALTAIR, or SAIPH, based on RCNLOQB results attained between 2000 and 2010. The study was initiated to determine what impacts, if any, the RCNLOQB results of the logistics officer have on the financial expenditure deviations. An ex post facto design is appropriate for the proposed study because the RCNLOQB results and financial expenditure deviation characteristics will use historical data versus deliberately manipulating any of the mentioned variables (Leedy & Ormrod, 2010).

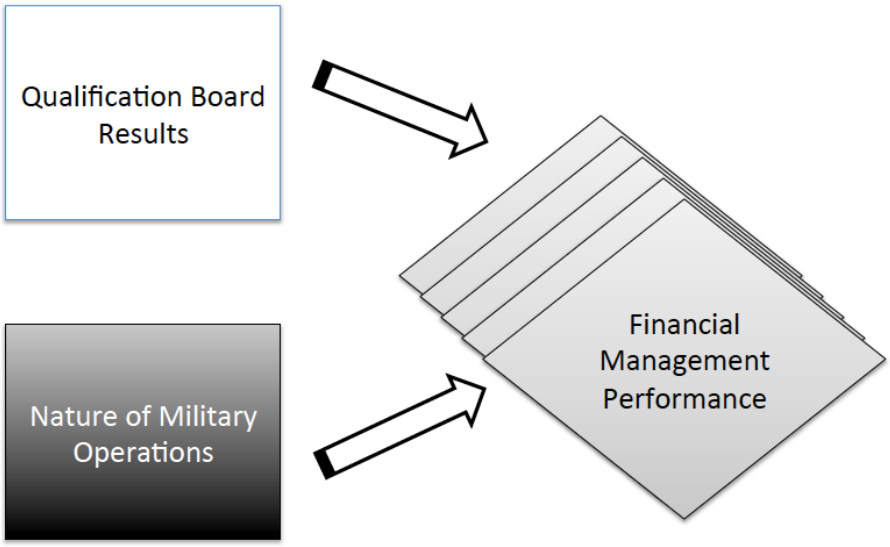
The comparative nature of an ex post facto method enables the researcher to determine the effect of the independent variables on the dependent variable by examining the observed differences in the historical characteristics (Leedy & Ormrod, 2010). The clearly defined independent and dependent variables reinforce the appropriateness of a comparative ex post fact design to determine the effect of the independent variable on the dependent variable. According to Leedy and Ormrod (2010), correlational studies examine existing circumstances; however, a correlational study would be appropriate to examine statistical association between variables in the absence of an identifiable independent variable. The existence of an observed difference in financial management results, as a dependent variable that is effected by some other independent variable, might lead to an experimental research method. However, the historical nature of the observed characteristics prevents the manipulation of the controlled independent variable, required in an experimental method.

By comparing the differences in financial management deviation results based on operational category, the nature of the ex post facto method of the proposed study appropriately enables the researcher to determine whether RCNLOQB results preceded the previously observed difference in financial management results. The nature of this study provides further insight into the presumed effect of RCNLOQB results on differences in financial management deviation; however, the limitation of not being able to manipulate the independent variable mitigates the ability to control confounding variables. The nature of ex post facto studies prevents researchers from drawing causal inferences from observed correlations.

Qualitative research design relies on the interpretation of general open-ended interviews and observations (Denzin & Lincoln, 2005). An open-ended approach would not solve the proposed research question because of its inability to focus on the relationship between the Royal Canadian Navy Logistics Officer Qualification Board results and financial expenditure deviation within Her Majesty's Canadian Ships that have deployed in support of Canada's military operations in Afghanistan on Operations APOLLO, ALTAIR, or SAIPH. A qualitative research design would offer insights into factors that may have influenced specific financial management decisions made by a particular RCN Logistics Officer; however, the influence of the decision's effect on the financial deviations in the relevant ship would not be clearly defined based on the differences observed in the historical annual financial reports. A determinant response to a relational question would not be observed through a general association to one of the three primary qualitative paradigms (Willis, 2007). The Royal Canadian Navy has been empirically conducting Qualification Boards since 2000. Qualitative analysis of

empirical historical financial and training results would produce loosely subjective information that could neither confirm not dispute the relationship of variables based on observed differences. In this study, the historical RCNLOQB results and financial deviations in HMC ships from 100% of the available records will be examined and compared. The comprehensive sample analysis approach was determined, consistent with the Central Limit Theorem regarding data distribution. The individual historical qualification results are attributed with Royal Canadian Navy Logistics Officers between the ranks of Lieutenant (Navy) and Commander, who have been posted in Canadian maritime units between 2000 and 2010. Individuals who performed operational fund management in Her Majesty's Canadian Ships during the 2000-2010 timeframe attained unique, individually identified historical RCNLOQB results. The differences between the deviations found in the historical, annual financial reports of operational funds based on individual historical RCNLOQB results will be comparatively examined through this study (Figure 1).

Figure 1: Details of Financial Management Performance Differences based on RCNLOQB Results and Nature of Military Operations

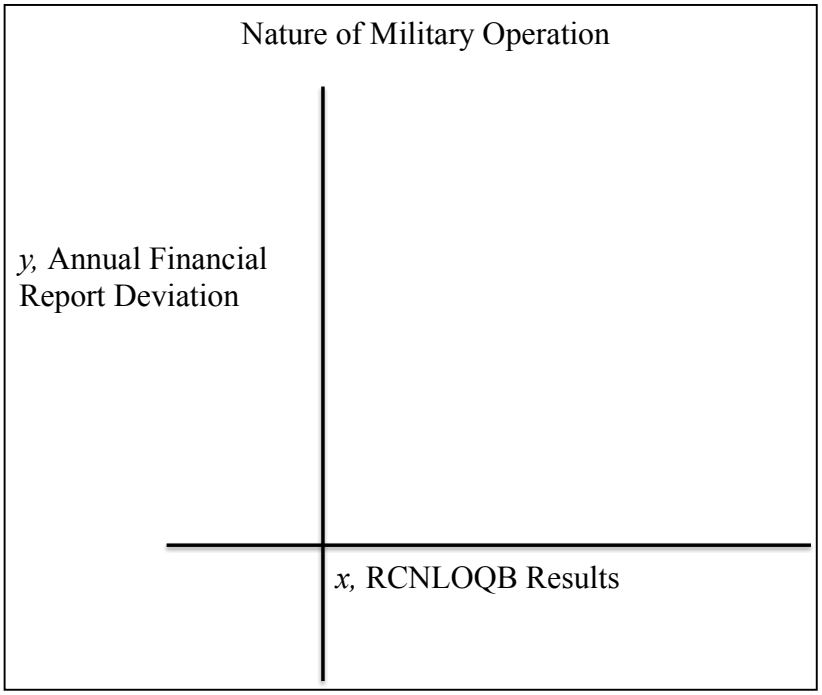


The characteristics of the research design sampled RCNLOQB results achieved by Logistics Officers between Developmental Periods (DP) Two and Four, who held a command position in one of Her Majesty's Canadian Ships, deployed in operations in Afghanistan on Operations APOLLO, ALTAIR, or SAIPH. Developmental Periods Two and Four were sampled to ensure that the RCNLOQB results being compared are consistent with activity that occurred in HMC ship's during the observation period of 2000 and 2010, versus introducing erroneous subjective data from RCNLOQB which did not effect observed differences between financial deviations in HMC ships during the period. The sampled financial deviations were compared and categorized based on the relevant RCNLOQB result and nature of military operation to ensure a comprehensive representation of all data relevant to the study. The final financial deviation reports of all HMC ships that engaged in military operations between 2000 and 2010 were included in this study.

Historical financial data from 2000 and 2010 was retrieved from Level Two Chief Financial Officers in Maritime Pacific, and Maritime Atlantic RCN formations, with consideration of public, annual-financial reports from the Canadian Joint Operations Command (CJOC) within the Department of National Defence. Training performance outcomes related to RCNLOQB results from 2000 and 2010 were retrieved from the Royal Canadian Navy, Director of Navy Logistics historical training files. Specifically, financial and training data integrity and accuracy was assured under the auspice of public record access and management prescribed in the Access to Information (ATI), and Privacy Acts, managed through the Treasury Board of Canada Secretariat to the Department of National Defence, through a linear regression analysis.

Data was presented through narratives and graphs. Initially, the RCNLOQB results and financial deviation paired scores were plotted in a scatter diagram to determine if a correlation exists. If the null hypothesis was accepted, then results have been narrated to describe study findings. If the null hypothesis is rejected, the linear correlation has been determined through the product of deviations $((X - M_X)(Y - M_Y))$ and the correlation coefficient (r) for the sample was calculated $r = \Sigma[(X - M_X)(Y - M_Y)] / \sqrt{((SS_X)(SS_Y))}$, and the strength of the correlation was measured (Aron, Aron, & Coups, 2009). Correlation coefficients from the sample have been calculated for each of the three specific military operations to create categorized correlation coefficients, these coefficients were then compared using a t test, $t = r / \sqrt{((1 - r^2)/(N - 2)}$, to test the hypothesis and determine the significance of the correlation (Figure 2).

Figure 2: Annual Financial Report Deviation Linear Regression Model



Research Questions

Research questions used in this study are supported by the comparative methodology of the research. The basic design strategy of this quantitative study was to compare the differences in historical annual financial deviation results from HMC ships, recorded between 2000 and 2010, based on RCNLOQB results categorized by the nature of Canada's military operations in Afghanistan.

Research Question 1 (RQ 1): Do Royal Canadian Navy Logistics Officer Qualification Board results significantly effect financial expenditure deviation within Her Majesty's Canadian Ships?

Research Question 2 (RQ 2): Do Royal Canadian Navy Logistics Officer Qualification Board results significantly effect financial expenditure deviation within Her Majesty's Canadian Ships that deployed in Canada's military operations with the United States?

Research Question 3 (RQ 3): Do Royal Canadian Navy Logistics Officer Qualification Board results significantly effect financial expenditure deviation within Her Majesty's Canadian Ships that deployed in US-led military operations with multiple nations?

Research Question 4 (RQ 4): Do Royal Canadian Navy Logistics Officer Qualification Board results significantly effect financial expenditure deviation within Her Majesty's Canadian Ships that deployed in a multinational campaign?

Research Question 5 (RQ 5): Does the nature of the military operation significantly effect financial expenditure deviation within Her Majesty's Canadian Ships?

Hypothesis

$H1_0$: Based on RCNLOQB results, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in recent operations between 2000 and 2010.

$H1_a$: Based on RCNLOQB results, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in recent operations between 2000 and 2010.

$H2_0$: Based on RCNLOQB results, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in Canada's military operations with the United States, as observed during Operation ALTAIR.

$H2_a$: Based on RCNLOQB results, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in Canada's military operations with the United States, as observed during Operation ALTAIR.

$H3_0$: Based on RCNLOQB results, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in US-led military operations with multiple nations, observed during Operation APOLLO.

$H3_a$: Based on RCNLOQB results, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in US-led military operations with multiple nations, observed during Operation APOLLO.

$H4_0$: Based on RCNLOQB results, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in a multinational campaign, observed during Operation SAIPH.

$H4_a$: Based on RCNLOQB results, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in a multinational campaign, observed during Operation SAIPH.

$H5_0$: Based on the nature of operation, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships.

$H5_a$: Based on the nature of operation, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships.

Conceptual Framework

Qualification boards have been utilized to provide a reasonable assessment methodology for measuring retained technical competencies acquired through military training (Ilecki, 2010). Attainment of the Royal Canadian Navy Logistics Officer qualification indicates the attainment of sufficient threshold technical knowledge to successfully function as a Logistics Officer at sea, providing operational support through the full spectrum of armed conflict scenarios. Assignment to operational units is not based on the attained RCNLOQB result. A number of factors, such as geographic preference, family circumstance, position availability, and financial resources influence member assignment to Her Majesty's Canadian Ships. Operational maritime units will be used as the baseline to identify relevant RCNLOQB trends in the proposed study. The comparative nature of the study is focused on explaining the effect of RCNLOQB results and nature of military operations on observed differences between annual financial deviation. The aggregation of unique RCNLOQB results will permit comparative analysis and linear regression to display the influence of the independent variables on the dependent variable (Deutsch, 1985).

Static, non-operational financial allocations are relatively much simpler to manage than operational budgets because of infrequent, unforecasted requirements (Ellis & Greene, 1960; Hollowell & Mazurek, 2008). Covariant influence between unforecasted expenditure and static budgets is a primary factor that negates final financial deviations (Deutsch, 1985). Static budgets do not offer a realistic comparative research model for the difference between financial management outcomes based on training performance results because of their mitigating covariant factors. Operational budget management requires satisfaction of present requirements, coupled with informed anticipatory financial management decisions with higher headquarters to forecast future requirements that will require additional resources or might result in spending slippages that create operational surpluses (Treasury Board of Canada Secretariat, 1997). Financial management proficiency is anticipated within the RCN based on the anecdotally assumed influence of training results on observed job performance differences. Comparing differences in job performance based on training qualification results over a time series should provide insights into the influence of RCNLOQB results on annual financial historical results based on the observed differences in the financial reports.

For the purposes of this research study, historical data regarding Her Majesty's Canadian Ships' operational, fiscal year-end financial positions has been sought from the Royal Canadian Navy, including the relevant RCNLOQB results for the financial reporting year of observation. Each unique qualification board result will be used as an independent variable in this proposed study.

Definition of Terms

Canadian Forces Individual Training and Education System (CFITES): Military personnel training is conducted within the comprehensive training method, design, assessment, and evaluation framework of CFITES within the Canadian Armed Forces. All requisite military occupations are compiled of validated military tasks, skills, and knowledge requirements in accordance with CFITES to ensure transferability and consistent performance outcomes. The organizations training production capabilities are determined through the CFITES resource minimization model (Department of National Defence, 1997).

Canadian Joint Operations Command (CJOC) *formerly Canadian Forces Expeditionary Command (CEFCOM) and Canadian Operational Support Command (CANOSCOM)*: Responsible directly to the Chief of the Defence Staff, CJOC is the military higher-headquarter organization responsible for all dimensions and phases of domestic and expeditionary operations within the Canadian Armed Forces based on the exigencies prescribed by the Government of Canada (http://www.cjoc.forces.gc.ca/wwh-qqc/mission-eng.asp#mandat).

Logistics: A military science that encompasses a comprehensive planning, execution, and sustainment effect to realize deliberate, contingent, and responsive military activities, in a static and operational context. The logistics effect includes supply chain, finance, and personnel resource management specialties to mitigate environmental idiosyncrasies, which might otherwise impede operational activity alternatives (http://www.nato.int/docu/logi-en/1997/lo-103.htm).

Royal Canadian Navy: The Royal Canadian Navy is defined as "a versatile, multipurpose and combat-capable force that diligently protects Canadian interests by safeguarding maritime approaches, exercising sovereignty over waters, protecting offshore natural resources and contributing to global security. The navy is composed of approximately 8,500 regular and 5,100 reserve sailors, along with 5,300 civilian personnel" (http://www.navy.forces.gc.ca/cms/12/12_eng.asp).

Royal Canadian Navy Logistics Officer: A military officer who is a member of the Royal Canadian Navy that works in one or several of the primary logistics disciplines, but primarily focused on supply chain management and finance (http://www.forces.ca/en/job/logisticsofficer-73).

Operation ALTAIR: "*Operation ALTAIR* was Canada's contribution of warships to operations supporting *Operation ENDURING FREEDOM* in the Persian Gulf and the Arabian Sea. On each of the first four rotations of *Op ALTAIR*, a single Halifax-class frigate was integrated into a U.S. Navy carrier strike group on reaching the area of responsibility. On the last rotation, a three-ship Canadian task group operated with Combined Task Force 150" (http://www.cjoc-coic.forces.gc.ca/exp/altair/index-eng.asp). The operation was conducted from January 2004 to September 2008. (http://www.cjoc-coic.forces.gc.ca/exp/altair/index-eng.asp)

Operation APOLLO: "Canadian Forces (CF) contribution to the international campaign against terrorism. The operation was conducted in Afghanistan and the Persian Gulf (Arabian Gulf) region October 2001 - October 2003" (http://www.cjoc.forces.gc.ca/exp/po-op-eng.asp).

Operation SAIPH: "From 25 October 2009 to 31 May 2012, *Operation SAIPH* was Canada's periodic participation in the international campaign to enhance maritime security in the North Arabian Sea, the Persian Gulf and the waters around the Horn of Africa" (http://www.cjoc-coic.forces.gc.ca/exp/saiph/index-eng.asp).

Assumptions

Canadian Forces Logistics Officers who successfully achieved the Royal Canadian Navy Logistics Officer Qualification underwent a subjective qualification board. The board assessed the competencies of candidates based on their oral responses to predetermined, although randomly selected questions. It is acknowledged that despite the fact that every individual evaluation was probably unique for each candidate, the aggregate summation of questions represented a comparatively consistent evaluation criteria and standard. The assessed response valuation of each unique board member varies, and is assumed to have been consistently applied towards all candidates by the relevant board member, although the assessors and candidates had previous knowledge of one another. Essentially, the subjective nature of the RCN Logistics Officer Qualification Board in assumed to have no bearing on the evaluation score received by any of the candidates (Ilecki, 2010; Pelissero, 1984), or otherwise stated, response valuation is equally biased and mitigates any advantage or disadvantage that might effect financial management performance.

The composition of the Qualification Board is assigned to specific positions within the Royal Canadian Navy, and as such, the individual assessors may vary between boards. Individual assessor biases are assumed to have had a negligible effect on candidate results (Yanichko, 1995). Gender stereotypes were significantly observed in

military training prior to 1990 (Boldry, Wood, & Kashy, 2001). Despite the consistently low absolute proportion of women Naval Logistics candidates or assessors, it is assumed that gender stereotypes did not effect qualification results based on the aligned representation of women in Naval Logistics compared to the Canadian Armed Forces overall.

The dynamic nature of military operations possesses inherent uncertainties that are managed by operational commanders based on informed risk assessments (Momen, Taylor, Pietrobon, Gandhi, Markham, Padilla, & Sander, 2010; Turner & Tennant, 2010). It is assumed that the propensity of military operation uncertainty is an extant factor in all missions. Financial deviations are attributable to the relevant, managing Royal Canadian Navy Logistics Officer versus an unidentifiable environmental factor (Pugliese, 2008).

Limitations

This ex post facto research design has been selected to analyze data observed between 2000 and 2010. A limitation of this study is the non-experimental nature of the research design. The inclusion of the terms *independent* and *dependent* variables may unintentionally convey controllable variables. The independent variables of the RCNLOQB results and nature of military operations cannot be manipulated within the proposed ex post facto design (Thompson & Panacek, 2007). Causal inferences are limited to the context of the observed historical data. For example, a causal inference might be expressed as, *in 2002, RCNLOQB results were observed to have a significant effect on differences observed in financial deviation results in US-led operations compared to 2004 for the same type of military operation*. Although an ex post facto design is a causal comparative quantitative method, causal inference cannot be

determined through correlation observed through to provide unbiased prediction of future outcomes (Thompson & Panacek, 2007). As a result of limited observed data sets related to financial management deviation in HMC ships, statistical inferences regarding the influence of RCNLOQB results and the nature of military operations on observed differences in historical financial reports are limited and may introduce bias into the results by nature of the research design. The lack of previous studies on variables effecting financial deviation in HMC ships and limited additional empirical data compound the possibility of statistical research error through multivariate analysis of variance testing.

Internal validity could be threatened due to the myriad of individual characteristics and personality nuances that may suggest alternate explanations to the research findings (Neuman, 2005). The cross-sectional approach of evaluating distinct officers from the Royal Canadian Navy limited the applicability of the findings to the other environmental branches of the Canadian Armed Forces. Internal validity was additionally threatened by the exclusion of contributing leadership financial decision-making considerations and individual competencies from the study. The consolidation of both male and female officers in the sample eliminates the ability to make gender-based determinations. Logistics is comprised of a broad array of activities and therefore differing combinations of those activities among officers may confound the findings from this study. The military context of logistics differs from that in other organizations because military logisticians are interested in supporting operations, where participating forces surrender unlimited liability to their respective governments, for employment purposes. The consequence of logistics failure in the military context can result in grave

outcomes as a result of this application. Limiting this study to a military environment impedes finding transferability and predictive inferences in other organizations that do not execute the same employment construct.

Delimitations

This study was delimitated by focusing on only the Royal Canadian Navy. It is acknowledged that the study could have been expanded to focus on the practitioners of all financial managing elements within the Canadian Armed Forces including both military and civilian personnel. The present design is deemed sufficient to satisfy the described research problem. This research study has been limited to only finance personnel within the Canadian Armed Forces versus all allied nations.

Summary

This quantitative ex post facto study has the potential to increase financial resource management effectiveness in military and para-military organizations that have prescribed internal training programs to ensure reliable performance. The analysis of 10 years of historical data from the Royal Canadian Navy provides a solid foundation for future qualitative or mixed method studies. The data in this study will comprise an oversampling in historical Royal Canadian Navy Logistics Officer Qualification board results of 200 Canadian Armed Forces operational fund management personnel, determined through the central limit theorem. These results will be attributable with 100% of Royal Canadian Navy logisticians between the ranks of Lieutenant (Navy) and Commander, who have been posted in Canadian maritime units between 2000 and 2010. The RCNLOQB results are related with deviations found in the historical, annual financial reports of operational funds that were managed by those individuals. This study

will compare the differences in the historical financial reports based on military training results within a statistical significance of 0.05.

Chapter 2

Review of the Literature

The philosophical premise of military education, training, and evaluation can be traced to early classical works related to the development of wisdom and moral duty in management. Private business organizations predominantly measure the effectiveness of training based on either a cost/benefit or return on investment (ROI) scale (Kirkpatrick, 1998; Phillips, 1997). By virtue of their profit-oriented operations, these metrics are relevant to determining the influence of training on performance. Literature regarding the effectiveness of either approach is limited, and focuses on business process improvements, which are subsequently reflected in amended training versus training evaluation results that can be used to predict job related performance (Arvey & Murphy, 1998). In the public sector, academic research regarding the relationship between training evaluations and business performance is even further limited. According to Inbal (2011), inherent supplementary challenges exist in determining the impact and relation of training programs on financial performance in non-profit and public sector institutions, such as federal government departments, because of subjective performance goals. Operational financial management in Her Majesty's Canadian Ships is determined based on the absolute deviation between the planned and actual expenditure values. The appreciation that military operational expenditures fluctuate in response to various geo-political and economical factors compounds the challenge of determining clear performance criteria that are not profit-oriented.

As a federal organization, the Department of National Defence is restricted by Canadian legislation to conduct business operations without generating profits from

taxpayer-funded activities (Department of National Defence, 2007). It is challenging to apply contemporary training evaluation and business performance measure to military operations conducted by the Canadian Forces as neither benefits nor ROI can be easily identified within a non-profit, federally funded paradigm. Kraiger, Ford, and Salas (1993) discussed the relevance and importance of training evaluation to the development of sound and reliable instructional design models. However, despite the accepted importance of training evaluation within the instructional design community, psychosocial behavioral research has not generated a theoretical design model for training evaluation (Kraiger, Ford, & Salas, 1993). In the absence of a theoretical training evaluation model, practitioners develop customized assessment tools, relevant to the nature of their business objectives and training strategies, which creates challenges in conducting comparative future analysis. An ex post facto research design offers the ability to conduct non-experimental analysis of existing data to infer future outcomes with a degree of statistical significance based on the observed variables (Deutsch, 1985). Comparative analysis of historical data provides a benchmark for future ex post facto research verification and study replication to increase confidence in previous independent variable influences (Chapin, 1946; Chapin & Stryker, 1950). Personnel entrusted for the safe and prudent management of taxpayer dollars have a professional and moral obligation to realize performance excellence based on received training. Small (2011) discussed the philosophies of Aristotle and Cicero as seminal foundations in the education and training system of modern armed forces. “Unethical and illegal behaviour in business finance, marketing and public relations might have been averted and unforeseen and unpleasant consequences avoided, had there been a strong commitment to

the wisdom and ‘moral virtue’ (arete´) of Aristotle and the wisdom and ‘moral goodness’ (honestum) of Cicero in the pursuit and conduct of business” (Small, 2011, p. 845).

Training is a typical method of transferring knowledge, skills, and abilities. Training evaluation enables assessors to validate learned training objectives and grant relevant qualifications to successful candidates, which provides a defined standard of performance expectations, consistent with assessed training evaluation results. Within the Canadian Armed Forces, the Individual Training and Education System (IT&E) is based on three fundamental principles: performance orientation, systems approach, and optimum efficiency (Department of National Defence, 1997). Central to IT&E, content development is the primacy of effective and efficient resource management, including the expectation of financial prudence and probity. Financial management and expenditure training within the Department of National Defence effect a number of civilian classifications. General financial management training is focused primarily on the occupations within Logistics Branch of the Canadian Armed Forces (Department of National Defence, 2010). Logistics Officers within the finance specialty stream are regarded as the organizational military experts regarding financial management (Department of National Defence, 2010).

Figure 3: CFITES Overview (Department of National Defence, 1997, p. 2)

A review of contemporary and historical research in the field of performance based training evaluation revealed a significant lack of quantitative study regarding financial management training evaluation (Ilecki, 2010). The Canadian Forces training needs assessment for Logistics Officers describes a requirement for financial management capabilities, and possesses training programs to this end. However, training evaluations have not been previously studied to explain the relationship between training evaluation results and financial management performance. An ex post facto study design enables researchers to compare differences previously observed in the dependent variable based on training evaluation results to infer the effect of the independent variable on the observed difference in the dependent variable (Chapin & Stryker, 1950; Deutsch, 1985).

Training evaluation is frequently used synonymously with training effectiveness (Alvarez, Salas, & Christina, 2004). Although the concepts are related, they are mutually exclusive. Training evaluation assesses the successfulness of the training program design

based on individual adaptations resultant from training and business results. Training effectiveness examines the organizational, individual, and training-specific external circumstances effecting the preliminary, ongoing, and post training program periods. The nature of the proposed study will encompass a comparative evaluation of the difference between financial expenditure deviation based on RCNLOQB results. Alvarez, Salas and Christina (2004) observed that training variables could be accurately evaluated by training design and assessment experts through a controlled assessment of the training targets. Organizational and industry training experts produce reasonable and indicative assessment tools in the absence of a theoretical training evaluation model (Alvarez, Salas, & Christina, 2004). Non-experimental quantitative analysis enables testing of assumed independent variable influence on observed differences in the dependent variable without introducing random experimental factors or researcher bias to the analysis. A comparative design supports inferential statements based on previously observed data (Deutsch, 1985).

Kazbour (2011) described the degree in which trainees learned and demonstrated their ability to apply previously acquired knowledge, skills, and attitudes to the performance of a prescribed and predetermined task as *transfer of training*. The degree of training transfer and training penetration effectiveness is measurable by observing job-related performance outcomes (Kazbour, 2011). Comparative analysis of performance outcomes provides statistical confidence to the perceived influence and effectiveness of training transfer based on the level of observed statistical significance (Deutsch, 1985). Training transfer effectiveness is determined by composing a training evaluation that measures performance outcome against a prescribed standard (Kirkpatrick, 2006;

Tannenbaum et al, 1993). The results from the Royal Canadian Navy Logistics Officer Qualification Board are used as a training performance measurement tool to indicate training transfer through demonstrated RCNLOQB performance. Studies have shown that assessing training transfer to performance is an effective method of conducting a training evaluation. In the last 20 years, a positive correlation has been identified between evaluated training transfer and expected business outcomes (Alvarez, Salas, & Christina, 2004; Tannenbaum et al, 1993). Comparative ex post facto examination of the influence of RCNLOQB results as an independent variable, on performance outcomes such as financial deviation will enhance the depth of knowledge surrounding the differences in historical performance results based on training (Cooper & Schindler, 2002).

Business performance is not an exclusive training evaluation strategy nor training effectiveness indicator. Studies of personnel appraisal reports indicate that job performance does not consistently reflect prior training evaluation results (Arvey & Murphy, 1998). Qualitative research literature has shown that business performance is heavily influenced by factors external to training. One of the predominant non-training domains effecting performance is individual motivation (Arvey & Murphy, 1998; Tannenbaum et al, 1993). Kraiger, Ford, and Salas (1993) found that job performance was sub-divided into two contributing factors: goal orientation and attitudinal dimensions. Qualitative studies have predominantly focused on describing individual attitudinal effects on training evaluations, while quantitative research has primarily explained the relationship between goal orientation, observed through measured job performance, and training transfer (Alvarez, Salas, & Christina, 2004; Arvey & Murphy, 1998; Kraiger, Ford, & Salas, 1993). The influence of attitudinal factors has been

observed to effect business performance when examined through training evaluation models (Kazbour, 2011; Kirkpatrick, 2006; Tannenbaum et al, 1993). Kraiger, Ford, and Salas, (1993) determined that training programs consistently influenced motivational states, when the program was intentionally designed to effect attitudes. Training programs intended to produce non-attitudinal specific outcomes were observed to have an unintentional effect on performance related motivation, depending on the individual's degree of training proficiency (Williamson, 1939; Kraiger, Ford, & Salas, 1993; Tannenbaum et al, 1993). Kazbour (2011) posited that support, feedback, and goal setting were the three primary principles related to performance based training transfer methodologies. The principles indicate a predominant external psychosocial influence on performance that is not related to training evaluation. Antecedent to considering intrinsic individual motivation is the assumption that individuals select or are assigned to fulfill positions and responsibilities that are suited to their personalities and attitudes. Earnhardt (2012) indicated that U.S. Air Force personnel were not consistently assigned to responsibilities that complimented their attitudes and capabilities. Person-job fit was positively related to job satisfaction, however, no relationship was observed between person-job fit and job performance (Earnhardt, 2012). Placing an appropriate candidate in a position suited to the individual's aptitudes and abilities effected internal motivations regarding their personal satisfaction while completing the tasks; however, this motivation does not influence job performance. Werbel and Johnson (2001) found a positively correlated relationship between person-job fit and performance. A causal relationship was not observed between person job-fit and performance. Comparative, non-experimental analysis of historical results will permit statistical testing of the influence of the

independent variables on differences observed in the dependent variable. According to Earnhardt, although a number of factors influence an individual's perception and determination of job importance, the degree of job importance appreciation was not related to a motivation to increase job performance (2012,). The absence of observed relation between person-job fit and job performance suggests that job performance is more heavily influenced by factors other than individual motivation (Arvey & Murphy, 1998; Earnhardt, 2012; Kirkpatrick, 2006). Gowen and Tallon (2002) found that a relationship existed between training and the logistics domain of supply chain management. Armfield (2005) expanded upon Gowen and Tallon's (2002) findings and concluded that individual behavioral and attitudinal factors effected the degree of training and job performance correlation. Behavior was most significantly effected by external inputs related to interpersonal communications, interpersonal relationships, and group dynamics effecting business decisions (Gowen & Tallon, 2002). Training was related to job performance and confirmed the validity of training evaluation results, which could influence even greater individual job performance depending on external behavioral factors (Armfield, 2005; Eltantawy, 2005).

Rating scales are indicative of predetermined reporting products, and may not necessarily accurately represent training transfer. Planned versus actual percentage of deviation is the prescribed financial business performance measure within the Government of Canada. The scale is based on strategic financial reporting and may not be consistent with individual performance appraisal results, as identified in qualification board results when conducting a training evaluation. Arvey and Murphy (1998) concluded that environmental factors effected rater bias and performance scores.

Performance based evaluation is an effective method of determining training effect and potentially improving future performance when results are known by the subject (Reinke & Baldwin, 2001). The variations of rater bias and rating scales produce more reliable results when examined from a group versus individual perspective (Kazbour, 2011). Kazbour (2011) found that practitioner/supervisor relationships effected performance outcomes based on the interpretations of environmental variables and related business decisions. Kazbour (2011) suggested that collective perspectives surrounding business decisions are frequently obscured in quantitative performance based metric.

Education Evaluation and Assessment Methodologies

Evaluation was described as an essential element of education and training program validation (Tyler, 1950). Ary, Jacobs, & Razavieh (1972) described the relevance of research in education. Their germinal work supports the theory of improving performance by studying the educational activity of training in the business environment. Training evaluation results can be effected by subject attributes, which produce an unwanted error, defined as *test bias* (Choca, Shanley, & Van Denburg, 1992). Choca, Shanley, and Van Denburg's (1992) study results regarding the Millon Clinical Multiaxial Inventory identify a potential research challenge in using training evaluation results as a moderating research variable based on test bias. A quantitative analysis of training evaluation results can mitigate the adverse effect of sex, race, age, socioeconomic status, or education individual factor test bias on research findings (Choca, Shanley, & Van Denburg, 1992; Lamerson, 1989). Cojanu (2007) studied the effect of workforce development on economic development in rural communities in the state of Florida. The research sampled workforce development based on two distinct, age-

defined categories, *45 years and under*, and *over 45 years*. Cojanu's research is relevant to this study because it examined the effect of training on business outcomes in a population that has not been previously studies from this perspective. In addition to other findings, some of which were not relevant to this study, Cojanu (2007) found that age did not significantly influence individual attitudes regarding the effect of training on economic development. Cojanu's research concluded that a relationship existed between workforce education/training economic development opportunities. The lack of attitudinal age discrepancy in the study results suggests that test bias may be mitigated in training evaluation/training transfer correlational research (Cojanu, 2007).

Pugh (2009) posited that, education and training professionals have not resolved to determine and consistently adopt conventional research-based assessment tools that have been effectively applied within private sector organizations. Chapin and Stryker (1950) demonstrated that an ex post facto experimental design was a reliable research method and effectively created replicable study results. Poole (2007) specifically examined the performance outcomes related to Joint Professional Military Education. Process evaluations have been used to improve outcomes by focusing on performance-based results. Six Sigma, created by Motorola in 1985, is used by military organizations as process improvement tool, in conjunction with other education and training evaluation methods (Ilecki, 2010). The US Department of Defense has been an organizational pioneer in the Six Sigma process for quantitative, data-driven, defect elimination. According to Ilecki (2010) Six Sigma is applied to continuous process improvements and deviation reduction in the Army, Navy, Coast Guard, Air Force, and Marines. Researcher in the field of training evaluation techniques have suggested that performance

enhancements have been achieved through both training evaluations and process improvements. Business performance can be examined as a dependent research variable to explain the relationships between training and performance (Ilecki, 2010; Poole, 2007). Process improvement tools differ from training evaluations because they focus on identifying and rectifying process related inefficiencies versus targeting educational learning objectives and training transfer. Training evaluations focus on individual ability to apply learned skills in practical situations. Improvements in training programs frequently enhance performance (Ilecki, 2010; Tyler, 1950). Training evaluation literature has shown that specific learning criteria are direct determinants for job performance outcomes (Kraiger, Ford, & Salas, 1993 Surface, 2003).

A review of current and historical academic literature regarding military training evaluation within the Canadian Forces revealed a significant research gap in the area of the proposed study. The CFITES, constructed from common, allied, military education and training systems has not been appreciably studied by the Canadian Forces. The lack of research regarding the CFITES evaluation methodology compounds triangulation for this study regarding the potential relationships between military training evaluation methods and financial management performance. The lack of research literature regarding CFITES evaluation effectiveness has produced a self-validating system assessment. Guerra-López (2007), posited that performance measures with produced empirical metric were not necessarily effective in positively influencing training programs unless the entire program, from design to implementation, also underwent a comprehensive training effectiveness analysis to validate the training needs assessment and program objectives. A review of the literature indicates that the training objectives of

the Naval Logistics Development program and Qualification Board have not been rigorously studied to determine the appropriateness of the training evaluation as it relates the differences observed in financial management measures (Department of National Defence, 1998a). According to the Department of National Defence, "The purpose of the Evaluation phase is to ensure the effectiveness and efficiency of instruction. A programme is effective to the extent that the learner has achieved the performance objective(s)" (1997, p. 7). The current construct of the CFITES evaluation phase therefore assesses acquired professional qualification based on candidate training evaluation results versus job performance (Department of National Defence, 2003; 2011).

The Joint Professional Military Education system is commonly applied by numerous allied nations. The literature review provided in this chapter will expand upon the lack of specific research by making inferences on probable system results based on observations from related allied training systems in other nations. Poole's research supports the theory that a relation can exist between training and performance outcomes in a military environment. Quick (2011) studied and conceptualize a military model of Performance Based Logistics, for the US military. Quick's model confirmed the predictability of performance-based logistics. This research study will triangulate the relation of professional military education, conducted in the form of training, and performance-based logistics, related to financial management through a ex post facto research design. The Naval Logistics Qualification Board applies criterion-referenced measurement and assessment techniques to evaluate acquired individual skills and abilities through a situational practical test (Department of National Defence, 1998).

The pragmatic functions of logistics are divided into two distinct paradigms, financial and relational (Davis & Manrodt, 1992). Financial management effectiveness is dependent upon the degree of budgeted deviation observed while ensuring customer satisfaction. Relational management effectiveness is measured by assessing the economical efficiencies attributable with meeting customer expectations. Davis and Manrodt (1992) described the challenge of training and evaluating logistics abilities based on this dichotomy, and suggested that any assessment methodology may insert measurement uncertainty based on the contextual relevance of the selected evaluation tool in a given scenario. Gorman (2000) found that although multinational logistics is advantageous based on economy of scale and effort, activities are increasingly more difficult in a diverse multinational environment, and outputs consistently decline as the number of participating nations increases. Accountability of human resource development and accountability systems continues to gain international significance in the multinational business and financial environment (Brewer, 2007). Royal Canadian Navy Logistics Officers in Her Majesty's Canadian Ships retain sole responsibility for the effective financial management of public fund allocations while deployed. Research in the area of financial management training evaluation effectiveness has been limited because of cost and complexity related to assessing acquired skills. According to Brewer (2007), senior managers are results oriented regarding the expenditure of financial resources. Although organizational leaders are focused on increasing operational flexibility by creating economies of scale through improved financial management performance, the costs relevant to evaluating financial performance beyond a profit-oriented perspective are complicated. Brewer (2007) posited that training professionals

were generally unfamiliar with developing complex financial training evaluations. Comparing historical financial management results through non-experimental research would provide organizational leaders with a cost effective method of leveraging existing data to create inferences regarding training evaluation effectiveness. Brewer posited that Kirkpatrick's four-level framework for evaluating performance: Level 1, reaction; Level 2, learning; Level 3, job behavior; and Level 4, results; provided a viable method of confirming training and relationship validity. According to Kirkpatrick (1998; 2006), training established the fundamental knowledge base to assess and react to external situations; a relationship existed between the quality of the job behavior and results based on the evaluated degree of learning achieved during professional training.

Phillips' (1997) Five-Level Return on Investment (ROI) Framework provided a practical performance based training evaluation model. Brewer observed that Phillips' Five-Level ROI Framework is relevant to international and multinational financial support operations and suggests that training results observed in levels one and two, have a direct impact on the outcome achieved in the remaining three levels. In a dynamic operational military environment the financial advantage of Phillips Five-Level ROI Framework on training assessment is the additional ROI cost/benefit monetary appreciation. By observing the ROI in Level 5, it is possible to determine relationships related to the training cost benefit of business results (Phillips 1997; Phillips 2010).

Level 4, *Business Results*, of the Five-Level ROI Framework is commonly the most frequently assess stage to determine training effectiveness (Brewer, 2007; Phillips, 1997; Phillips, 2010). Calculating financial training effectiveness based on ROI is complicated due to the high number of variables. An analysis of seven comprehensive

training studies concluded that ROI as a specific indicator was assessed in less that 10% of all instances by one organization and declining to a minority application of 2.1% at its lowest frequency (Brewer, 2007). Brewer demonstrated the validity of conducting a 0.10 level of statistical significance for financial management performance. Brewer (2007) concluded that ROI was a possible, although impractical performance based, financial training evaluation tool. Brewer's posits suggest that concentration on business results or a Kirkpatrick evaluation strategy, such as financial actual/planned allocation deviation is an appropriate method for explaining relationships between training results and business performance (Brewer, 2007; Department of National Defence, 1998a; Kirkpatrick, 2006). The proposed non-experimental study leverages Brewer's 0.10 level of statistical testing significance relevant to Kirkpatrick's discussion regarding financial deviation as a dependent variable. Subjective findings and limited academic analysis of Kirkpatrick and Phillips' frameworks produce a challenge for research triangulation. Ilecki (2010) indicated that there is limited empirical evidence to prescribe either a prevalent or commonly applied training evaluation model or methodology within federal organizations.

Financial Performance Measures

Private sector, profit-oriented organizations use a number of empirical financial metrics to measure performance. The literature indicates that as few as six core financial measures are consistently used to determine organizational financial performance (Watkins, 2003). Watkins (2003) determined that in addition to traditional financial measures related to profitability and financial management efficiency, assessed through financial ratios, that non-financial measures were a relevant factor in describing

performance. The inclusion of three additional non-financial performance measures representing outputs, efficiency, and productivity (Watkins, 2003) provide a framework relevant to military operations because it rationalizes the dynamic complexity of Canadian Forces missions and defines performance measures, which describe supplementary factors that effect financial management performance. Non-financial measures were described as *intuitive assessments*. The challenge of applying non-empirical impressions on standard financial performance measure is the high potential for assessment inconsistency. Watkins (2003) found that non-financial measures were effective in describing contributing factors that influenced financial management decision-making in a complex operating environment.

Various activities effect the appropriate financial management decision-making and performance. The federal Government of Canada has used activity based costing as a performance measure in assessing the quality of financial decisions, improvements, and composite financial program success. Financial performance results are an important determinant of financial training programs (Federal Accounting Standards Advisory Board, 1994; Fortin, Haffaf, & Vigerl, 2007). Fortin, Haffaf, and Vigerl (2007) stated that to make economic choices, financial decision-makers required primarily information related to the cost of services. According to Fortin, Haffaf, and Vigerl (2007) supplementary financial information was an observed requirement in planning, budgetary and financial forecasts, mitigating costs, and establishing pricing models. The Government of Canada instituted the *new public management program* to improve results-based management of public resources (Treasury Board of Canada Secretariat, 1997). The application of an activity based costing performance measure informs an

antecedent training program, designed to simulate practical situations, which will prepare individuals to produce predictable performance results (Foster, & Swenson, 1997). Fortin, Haffaf, and Vigerl (2007) observed that organizational financial managers gained greater appreciation for Activity-Based Costing (ABC) activities, beyond rudimentary abilities, when inculcated in agency initiated learning programs that conveyed institutional costing values and strategies. Increased comprehension of organizational ABC goals enabled personnel to internalize corporate objectives and subsequently increase their motivation towards achieved set targets. According to Fortin, Haffaf, and Vigerl (2007), a relationship exists between simulated, activity based training programs, and financial management performance.

Baiman and Demski (1980) highlighted the traditional assessment of budget variance as a financial management performance indicator. In evaluating training programs and financial performance measures Baiman and Demski observed that the threshold of acceptable financial variance tolerance was heavily influenced by organizational quality control limits. According to Baiman and Demski, financial variance investigations and reconciliations increased commensurate with the existence, predominance, and rigor of internal control limits. The situational nature of the Naval Logistics Qualification Board simulates an operational control paradigm that enables the comprehensive evaluation of logistics domains, including finance (Kotane & Kuzmina-Merlino, 2012). The control limit is the Department of National Defence budget variance threshold, identified by the Government of Canada (Treasury Board of Canada Secretariat, 1997). The Basic Principal-Agent Model supports the determinant nature of

agent performance in support of principal expectations, consistent with training evaluation results (Baiman & Demski, 1980).

Military Training Theory

According to Shuford (2006), a former President of the U.S. Naval War College, a combination of both shore and sea-based training have been attributable to the significant increase in individual job performance competency and institutional expectations regarding performance in the Navy environment. The primary complexity of military training is centered in the challenge of managing an evaluation system that exercises the spectrum of maximal through typical performance expectations (Moilanen, 2012; Stanfill, 2012). According to Salas, Milham, and Bowers (2003), general training misconceptions and a lack of a common military training evaluation strategy have adversely effected the development of complex subjective evaluations in military institutions. According to Robbins (2009), it is appropriate to redefine the application of Kirkpatrick's Level 2 evaluation in a military context. A focus on clearly identified baseline proficiency, beyond rudimentary training transfer, enables the accurate assessment and evaluation of learned, task-oriented proficiency. Robbins (2009) posited that training evaluation was more effectively accomplished through assessment of performance outcomes in the military environment. Literature describes performance as paramount to business process, training, although germane to the military system is an incidental component of a job performance oriented system (Robbins, 2009). Robbins posited that effectiveness of training evaluations were related and determinant performance measures. Military training can be examined through a study of any of the relevant military branches; however, research regarding Special Forces provides

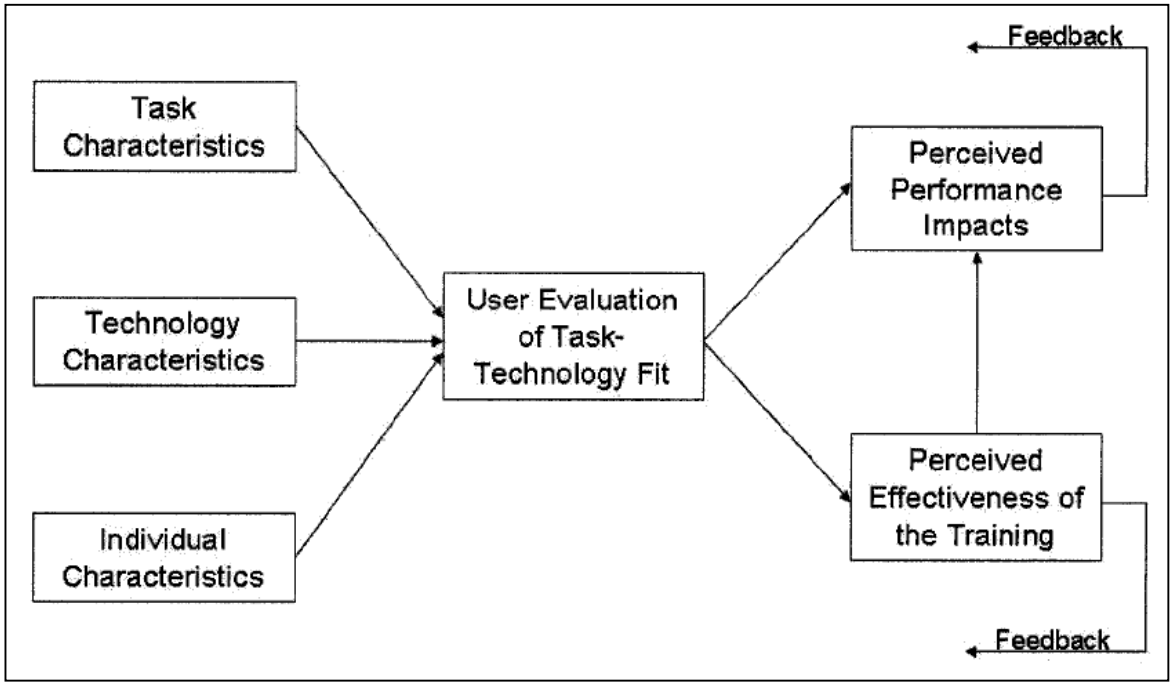
additional academic insight in to the effects of physical and psychological factors on performance related measures and explains the predictive relationship between training evaluation and job performance (Stanfill, 2012). Stanfill (2012) determined that Special Forces candidates applied various cognitive and behavioral aptitudes to overcome internal and external stressors during operational simulation and practical training. The training evaluation outcomes derived from Special Forces training suggest that simulation training evaluation enables individuals to consistently apply training transfer knowledge in evaluation assessments, which may then be used as predictive outcomes for practical operational performance indicators (Posey, 1993; Stanfill, 2012; Ward, 2006). Contemporary Naval Logistics training programs must consider and rationalize *volumetric* dimension significance in applying relevant training evaluations, which accurately assess learners' abilities to make effective financial business decisions in a complex international, military operations environment as recently observed in the Royal Canadian Navy's participation in Operation HESTIA to mitigate complexity theory influence (Hansen, 2010; Streufert, Pogash, & Piasecki, 1988).

Within military organizations, leaders consistently promote a systemic resistance to training evaluation based on the nature of the training and practical operational environment (Salas, Milham, & Bowers, 2003). Training evaluations within the U.S. Navy are observed through informal methods (Shobe & Curtis, 2007; Ruth, 2007). The culture of informal, subjective training evaluation to measure individual performance is consistent within the Royal Canadian Navy, consistent with U.S. forces. The Canadian Forces Navy Logistics Officer Qualification board evaluates training transfer based on subjective scoring performed by an assembled evaluation team. The evaluation board

receives no antecedent, formal training regarding the evaluation methodology (Department of National Defence, 2011). Consequently, absolute evaluation scores vary between board members and subsequent qualification boards. Shobe and Curtis (2007) identified task unfamiliarity and training duration as challenges towards producing effective performance results in the U.S. Navy. The Royal Canadian Navy experiences consistent challenges with U.S. Navy studies, where relatively junior and inexperienced candidates undergo training related to an unfamiliar task. According to Hansen (2010) the instruction of logistics competencies is conducted in a relatively ad hoc manner. The lack of prescribed professional instruction introduces the potential for performance discrepancies between different individuals. The military training ethos is centered on challenging candidates in *uncomfortable* circumstances to help simulate the operational complexities in actual working environment (Department of National Defence 1998; 2003). Simulations are relevantly contextualized based on their task-technology fit (Cane, 2008). Predominance of technology integration in simulation development increased based on the technological complexity of the task. Financial management is not a technologically complex activity, although technological tools are frequently incorporated into business processes and tools. Performance validated financial training evaluations have been observed to encourage individual attitudes that enhance appropriate financial decision-making (Jahnke, 1998). Cane (2008) determined that close task-technology simulation fit produced a positive correlation between training outcomes and business performance. The literature review consistently reflected research findings that military training evaluation is predominantly accomplished through summative assessment, reinforcing training objectives. This approach verifies individual knowledge

retention but does not explain the relationship between the appropriateness of the training evaluation program and job performance. The systemic military approach of summative training evaluation does not verify the appropriateness of training objectives with job performance measures (Inbal, 2011; Robbins, 2009; Surface, 2003). The gap in training evaluation validation with job performance creates a challenge in determining a causal relationship between training results and job performance.

Figure 4: Cane Task-Technology Fit Model (Cane, 2008, p. 3)



Practical performance outcomes could be predicted by analyzing simulation, training evaluation results. A theoretical qualification board is an effective training evaluation method for logistics domains. Cane (2008) posited that learner's performance could be predicted based on an evaluation of individual ability to apply trained processes in a simulated system. Military training simulations replicated a broad spectrum of

operational situations ranging from single unit tactical transactions through joint theatre level simulations. The key performance indicator was individual input/response to the simulation (Cane, 2008). RCNLOQB results are an effective independent variable in explaining the effect of simulation-evaluated training transfer on differences observed in practical business performance measures. The qualification board framework enables board members to evaluate individual training transfer that should be consistently observed in practical military operations (Cane, 2008; Department of National Defence 1998). Shobe and Curtis' (2007) training assessment of the U.S. Navy's Submarine Electronics Computer Field apprentice program using Kirkpatrick's Four Levels of Training Evaluation Framework identified several challenges specific to military training systems related to a general lack of empirical rigor to produce valid and reliable determinations. The reported general lack of systemic quantitative rigor in military training assessment contributes to the lack of quantitative study in the field because of limited reliable empirical data (Tasca, Ensslin, Ensslin, & Alves, 2010). Tennant, Boonkron, and Roberts (2002) posited that rigorous evaluation of appropriate training programs enhanced individual and organizational performance.

Mangos and Arnold (2008) asserted that, organizational performance improvement initiatives were positively effected by targeted performance measurements that focused on know job performance discrepancies. Precise performance measurement was observed to improve organizational training evaluators' assessments of trainee potential and facilitate increased in demonstrated performance. Colarelli and Montei (1996) indicated that training practices were most effective when the desired training outcome was consistent in an expected job performance context. The Royal Canadian

Navy Logistics Officer Qualification Board training evaluation tool is not specifically focused on financial management exclusively. By applying Kirkpatrick's training evaluation framework, Sipko (2010) found that when simulated training evaluations did not accurately represent intense practical operating environments, no relationship existed between training evaluation results and performance regarding combat operational stress management in U.S. Marines; however, training evaluation and job performance were positively correlated when training environments provided a realistic simulation. Non-experimental analysis of differences in financial management job performance and training evaluation enables researchers to statistically test the influence of the training evaluation independent variable on differences in the dependent performance result, through a historical and repeatable research design (Chapin, 1946; Deutsch, 1985). Sipko (2010) posited that high training evaluation results were predictors of high performance expectations in U.S. Marines. The Royal Canadian Navy Logistics Qualification Board is a comprehensive practical evaluation that examines all trained logistical domains. The financial operational budget performance measurement is supernumerary, although relevant, to the core function of financial management. According to Mangos and Arnold's (2008) conclusions, comparative analysis of the differences observed in the financial deviation dependent variable based on the Royal Canadian Navy Logistics Officer Qualification Board training evaluation process in this proposed study should indicate an appreciable effect of the independent variable on the dependent variable within a 0.10 level of statistical significance.

Qualification boards are an effective method of challenging candidates with situational-specific problems to evaluate the penetration of behavioral and cognitive

training objectives. Enhanced board results typically produce improved practical results during actual situations. As a social institution, military organizations are oriented to be accountable to its citizens for the sound management of valuable and finite resources such as personnel, equipment, and finances. Military training systems in the Canadian Forces endeavor to produce reliable social responses to predictable problems through practiced training methods such as qualification boards. Training background has been observed to influence perspective and situate planning orientation (Siebold, 2001). According to Siebold (2001), military training frameworks can be designed to encourage prescriptive predominance, which promote preferred responses.

The reality of complex, contemporary socio-technical paradigms demand a robust military training environment that encourages and effectively assesses individual abilities interpret and resolve unconventional problems to successfully achieve expected results in an operational environment (Firing, Karlsdottir, & Jon, 2009; Skyttner, 2005). Clausewitz's seminal notion of Systems Theory captured the complex and dynamic nature of the military environment and raised consideration that a systems approach to solving problems both adapts in response to its environment while the environment concurrently adjusts around the system (Clausewitz, 1976). US military doctrine builds upon Clausewitz's work in the *General Systems Theory* (GST). The GST is an approach of military training models permits the applicability of meta-disciplined evaluation techniques across a broad spectrum of known disciplines. Within the context of the GST, modularized training measures are deemed to be an appropriate method to predict future performance outcomes (Schilling & Paparone, 2005). Defee, Williams, Randall, and

Thomas (2010) discussed the common military educational objective of instructing transaction cost economics.

The predominance of academic theory in military logistics theory was observed only 53% of the time in the reviewed literature (Defee, Williams, Randall, & Thomas, 2010); therefore, despite the application of subjective training tools to develop behavioral and cognitive competencies, candidates with exemplary evaluation results may experience inconsistent, and considerably lower practical results. The subjectivity of determining definitively prescriptive training modalities was attributed to the abstract relationship of service-dominant logic to performance-based logistics (Randall, Nowicki, & Hawkins, 2011). The literary lack of common psychological criteria acceptance and application in military training evaluation and job performance is referred to as the criterion problem (Surface, 2003). Surface (2003) posited that, some organizational training authorities have conducted operations in the absence of validated job performance criteria. In the absence of an accepted job performance criteria, Surface observed that the established training evaluation criteria was adopted by the organization as the appropriate job performance measure. The criterion problem presents challenges in triangulating the relationship between training evaluations and job performance in the Canadian Armed Forces with recorded observations other military and para-military organizations because each distinct entity self-promotes the validity of their respective measurement criteria (Robbins, 2009). A comparative ex post facto research design is an appropriate strategy to mitigate the criterion problem because the dependent variable is uneffected which increases the statistical power of the results based on the sample size and repeatability of the study.

Jaques' Stratified Systems Theory

This hierarchical, career progression and advancement system of the Canadian Armed Forces is based on Jaques' Stratified Systems Theory. The organizational foundation of Jaques' Stratified Systems Theory (SST), applied to the Canadian Armed Forces, leverages the military professional development systems based on fundamental training and educational principles to enhance outputs (Jaques, 1985). Burnett (1985) stated that, sound organizational professional development and training plans are specifically designed to support individuals in reaching their potential and overcoming adversity through well timed, and relevant instructional opportunities. Military training programs enable individuals to advance towards new roles and responsibilities, prepared to realize predictable job performance standards, consistent with historical training evaluation and assessment criteria. Career advancement within the military environment is based on job performance and behavioral attitudes. Training evaluations are applied as determinant factors in the identification of potential to assume greater responsibilities in the future (Burnett, 1985). In-house training programs have been observed to favorably enhance individual motivation and produce positive performance outcomes more quickly than outsourced solutions (Burnett, 1985). The in-house nature of Royal Canadian Navy Logistics Officer training should produce a positive relationship with job performance related to the evaluation criteria (Burnett, 1985; Jacob, 2010). Jacobs (2010) described the competitive advantage of developing mental models based on specific training, within an organizational context to deconstruct and resolve complex business problems. Royal Canadian Navy Logistics Officers apply acquired training to financial management situations in Her Majesty's Canadian Ships while supporting operations. The hierarchical

design of the Canadian Armed Forces minimizes behavioral attitude effects on performance outcomes based on the concentration of the mid-level manager Royal Canadian Navy Logistics Officer position. (DiPadova & Faerman, 1993). The Canadian Forces SST organizational model is further delineated in the Royal Canadian Navy, which subsequently tests and qualifies Royal Canadian Navy Logistics Officers to perform operational support duties at sea. The proven ability to construct cognitive solutions is a direct outcome of the SST.

According to Jacobs (2010), situational perceptions are unique to individuals based on their experience. Jacobs posited that these perceptions were consistent with recognition primed decision-making theory, and influenced individual situational assessment frameworks. Larwood, Falbe, Miesing, and Kriger (1995) described the organizational leadership dimension of sound management decisions from a visionary perspective. Leaders possessing supplementary experiential and educational abilities demonstrated enhanced competencies related to managing complex business problems such as operational financial allocations.

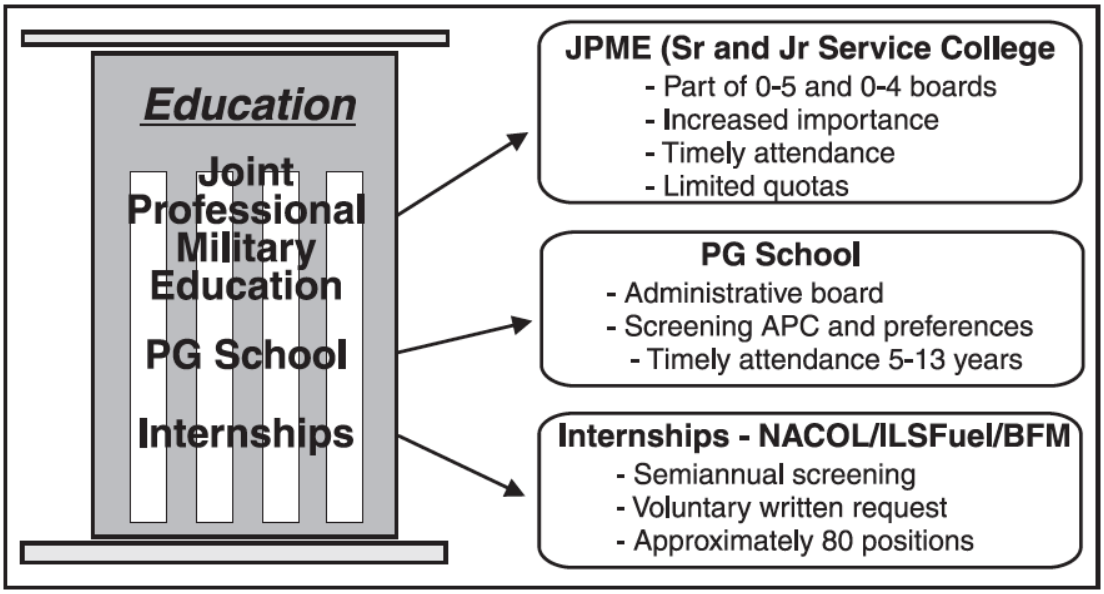
The effect of Jaques' SST enables a trained ability to leverage competencies and realize effective decisions (Guillot, 2003; Zaccaro, 1996). In managing departmental financial resources in an operational environment, Royal Canadian Navy Logistics Officers interpret strategic decisions at the tactical level, which produce operational effects for deployed ships. The Royal Canadian Navy Logistics Officer Qualification Board assesses candidates' ability to resolve complex business problems in a HMC ship environment. The ability to deconstruct problems and design cognitive solutions supports the validity of this evaluation method, and reasonably attributes a degree of expected

ability based on achieved results. Kur and Bunning (2006) posited that leaders made decisions and took action from an ontologically arrogant position, biased heavily by their perceptions and projections of reality based on individual inferences versus the precise circumstances of the situation. Consistent with Jaques' SST, the Royal Canadian Navy Logistics Officer Qualification Board develops *double-loop* learning (Kur & Bunning, 2002; Dai, Tang, & De Meuse, 2011). The RCNLOQB has consistently provided the Royal Canadian Navy with a reasonable measure of behavioral and cognitive management competencies related to operational finances in the naval environment.

Joint Professional Military Education

Professional development of military officers is conducted similarly by all allied nations such as Canada, U.S., and UK. The 1990, U.S. Chief Financial Officer (CFO) Act elevated the acknowledged requirement for reliable prudence and probity in public fund management. The CFO Academy was created within the National Defense University in 2008. Ruth (2007) posited that JPME institutional ethos should reflect joint education, and interagency connectedness to increase effectiveness between the various participating joint entities. JPME compliments antecedent training programs to produce military officers that possess and enhanced capability to overcome complex, joint operational challenges based on previous performance.

Figure 5: U.S. Navy Education Pillar (Sanford, 2010)



Ruth (2007) described a determinant relationship between JPME institution performance and prior training evaluation results. The Joint Professional Military Education program partially fulfills the training requirement for defense financial management although evaluation methods vary between branches and nations (Aguilera, Holmberg, & Gregory, 2009). Strategic perspective gained through JPME enhances a *Problem-Based Learning* methodology such as Royal Canadian Navy Logistics Officer Qualification training, which is based on operational situations (Auerswald, Breslin-Smith, & Thornhill, 2004). Auerswald, Breslin-Smith, and Thornhill (2004) observed that Problem-Based Learning (PBL) was an appropriate instructional methodology when students were expected to reproduce performance objectives in practical, real-world situations. PBL was observed to be effective in both individual and group problem solving scenarios. The JPME program differs from traditional academic post-graduate studies by offering learners a progressive education and training environment that

leverages situational, multi-disciplinary simulations related to practical operational military challenges.

Reyes (2012) described the benefit of applied training and evaluation methods, similar to the Royal Canadian Navy Logistics Qualification Board, in the deployed Observer, Coach, Trainer (OCT) system. The mentored OCT, JPME training system enabled candidates to train under the supervision of a qualified practitioner. Intuitively, candidates who received more favorable evaluations from their assessors were expected to produce improved future responses. A limitation of the JPME program is the inherent subjectivity, which can adversely influence the predictability of future results. Poole (2007) researched training transfer in JPME candidates. Poole concluded that despite skills development within trainees, no empirical evidence was observed to support the theory that training appreciably influenced attitudes and perspectives in JPME students.

Central Limit Theorem

A review of academic research literature suggests that central limit theorem is applied to make real and variable statistical inferences about *fuzzy* numbers (Amiri & Deiri, 2011). Financial business decisions taken during military operations are relevant observations for central limit theorem analysis due to the randomness of the influencing factors. Amiri and Deiri (2011) suggested that central limit theory was an important and effective method for structuring imprecise and random data series from empirical research. Financial performance in Her Majesty's Canadian Ships is measured consistent with +/- 0.5% deviation of planned versus actual operational budget expense ratio. In an instance where financial management performance variables are identically distributed the limit of the mean may be inferred using the central limit theorem (Yosh, 2012). Shang

(2011) posited that central limit theorem for dependent variables was a primary research area in the last decade. According to Shange (2011), general measures of dependence could be developed by integrating mixed, random data sets from dependent and independent variables based on an expected normal distribution function of averages supported by the central limit theorem. Consistent with the assumption of this proposed study, RCNLOQB results are expected to follow the central limit theorem; similarly, financial budget deviation should follow the same predictable distribution around the mean. An ex post facto research design enables comparative analysis, through statistical testing, of normally distributed dependent and independent variables to infer the effect of the independent variable on differences in the dependent variable. Kim and Luo (2010) observed real-time random variables, and were consequently able to determine the density of non-specific parameters based on regression estimators. The explanation of parametric financial business decisions is challenging in the military environment due to the complications of time constraints on individual stress related to making appropriate decisions and the subsequent performance results. Analysis of non-specific parameter density in consideration of various regression estimators could be applied to statistically infer the circumstances influencing individual time-sensitive business decisions for actual random variables (Kim & Luo, 2010; Senatov, 2011). The non-experimental research design of the proposed study can statistically test the differences observed between financial management performance deviations based on the effect of RCNLOQB results through linear regression.

Conclusion

A review of the academic literature regarding logistics education, training, and evaluation methods produces a varied approach to the activity. Numerous processes and practices are currently being applied based on subjective observations in the absence of significant empirical data or study. The lack of robust academic literature regarding optimal logistics training methods supports the appropriateness of the Royal Canadian Navy Logistics Officer Qualification Board evaluation method as a reasonable means to aggregate board member consensus for determining a candidate's financial management competencies. RCNLOQB members apply a subjective perspective to assess technical knowledge and presentation confidence based on a predetermined scoring criteria.

The premise of the Royal Canadian Navy Logistics Qualification Board maintains the fundamental principles of moral duty in management, and should provide inform historical assessments of financial management in operational deployments based on the evaluated performance of the candidate in the board. The Royal Canadian Navy's training methodology is assumed to have a determinant effect on job performance. The relationship between training evaluation and job performance in described through a number of educational design and development evaluation studies. However, the military paradigm has not produced significant advances in academic literature regarding empirical relational studies regarding training evaluation and job performance.

Summary

Logistics training and testing methodologies vary across a broad spectrum of tools and practices based on the emergence of new educational concepts and practical applications of logistics theories (Daud, Ling, & Keoy, 2010; Gilmour, 1978). The

foundation of military education and training as it relates to logistics is centered on the principle of moral duty in management. Military training is further refined through the Joint Professional Military Education system (Richardson & Gilhool, 2009; Sanford, 2010). The Royal Canadian Navy's application of a Royal Canadian Navy Logistics Officer Qualification Board as its primary evaluation tool for measuring candidate competency, shares a common theory with the reviewed academic literature. However, as stated by Poole (2007), a significant lack of empirical research exists regarding the precise accuracy and advantage of any identifiable logistics-training model as a definitive strategy to producing reliably consistent financial management competencies. A quantitative, ex post facto research design enables the non-experimental analysis of historical data to produce statistical inferences and comparative benchmarks for future studies. The influence of attitudinal factors on job performance, isolated from training evaluation, remains a significant gap in the academic literature. Statistical inference tools such as central limit theory, linear regression, and logit regression provide limited comparative analysis opportunity about the influence of training evaluation on differences between job performance results based on external and secondary contributing factors.

Chapter 3

Method

Previous research studies have suggested that qualifications attained through military training increase the reliability of predictable operational management decisions (Yanichko, 1995). Logistics officers within the Royal Canadian Navy complete maritime-specific, logistics training within the first two developmental periods of their occupational progression. The proposed study expands previous research regarding the effectiveness of qualification evaluations of initial military training (Yanichko, 1995), consistent with the Canadian Forces Individual Training and Education System. The empirical data regarding the development of effective and predictable financial management capabilities for federal resources is a gaped area in the current literature. Previous qualitative research has specifically examined the effectiveness of evolutionary techniques in assessing candidate capabilities in managing federal funds (Ilecki, 2010). In this non-experimental study, the comparative focus on operational fund management, observed through differences in historical financial deviation, was used to determine the effect of qualification boards results on financial management within Her Majesty's Canadian Ships.

The purpose of this quantitative, non-experimental, ex post facto research study (Ary, Jacobs & Razavieh, 1972; Chapin & Stryker, 1950; Galfo & Miller, 1970; Isaac & Michael, 1971) was to compare the differences between financial expenditure deviations within Her Majesty's Canadian Ships (HMCS), based on Royal Canadian Navy Logistics Officer Qualification Board results attained between 2000 and 2010, and the nature of Canada's military operations in Afghanistan (OPERATIONS APOLLO, ALTAIR, or

SAIPH) between 2000 and 2010. The final reported financial position (surplus/deficit), of operational ships that have deployed in support of Canada's military operations in Afghanistan (Operations APOLLO, ALTAIR, or SAIPH) between 2000 and 2010, may indicate the financial management deviation (dependent variable). The historical Royal Canadian Navy Logistics Officer Qualification Board results of 200 Canadian Forces personnel (independent variables), determined through the central limit theorem, comprised of 100% of Royal Canadian Navy Logistics Officers between the ranks of Lieutenant (Navy) and Commander, was studied. The difference between annual historical financial reports, based on RCNLOQB results was comparatively analyzed based on the operational nature of the sampled HMC ship's deployment (independent variable). Historical, Royal Canadian Navy Logistics Qualification Board results were compared based on relevant HMC ship's financial deviations from 2000 and 2010. The difference between the deviations found in historical, annual, operational financial reports, based on the nature of military deployments, and RCNLOQB results and were examined and described in this study. The use of existing data through this ex post facto study has enabled a non-experimental, comparative, evaluation of differences in historical financial deviation will enable analysis that may indicate trends, which predict future financial deviation outcomes, based on RCNLOQB results. Statistical inferences will be tested at the 0.05 level of statistical significance.

Research Design

The methodological approach selected to investigate the problem was a quantitative, non-experimental, ex post facto research design. Quantitative research is considered confirmatory and deductive in nature (Cooper & Schindler, 2002; Leedy &

Ormrod, 2009). Luo, Shi, Li, and Miao (2008) effectively determined that a quantitative ex post facto research design was effective in studying job performance in military soldiers. The comparative determination of independent variable influence on the differences observed in the dependent variable may reveal inferences in performance outcomes. The perception of a correlation between the independent variables and observed differences in the dependent variable of an ex post facto method does not constitute the existence of causation (Aron, Aron, & Coups, 2009). According to Christensen, Johnson, and Turner (2011), a comparative research approach is effective in statistically inferring future outcomes based on observed differences in the dependent variable. The comparative approach of this study will analyze the validity of rejecting the null hypotheses to demonstrate an influence of the independent variable on the differences between the dependent variable, error bound within less than 5% of the estimated proportion of the mean for the sample. An ex post facto research design is appropriate for comparative analysis. The time frame in the proposed study encompasses a decade of observation. Comparative analysis of the differences observed in the dependent variable, based on the effect of the independent variables over the observation period will enable statistical inferences regarding the influence of the independent variables on differences in the dependent variable.

This research study was conducted to compare the differences in financial management performance based on military training evaluation results and the nature of military operations. Unique historical military training evaluations results have been analyzed and compared with the relevant operational budget deviation for a particular category of military operation between 2000 and 2010. Any influence of training

evaluation results on differences between financial job performance results were investigated and analyzed within the 0.05 level of statistical significance. The degree of direct influence of the independent variable on the differences in the dependent variable may further enable statistical inferences that limitedly predict future financial deviations based on RCNLOQB results and the nature of military operations. The lack of previous research literature describing the characteristics of the population's RCNLOQB outcomes results in the absence of known statistical information attributable to the population. The basic research design of this study was progressed through application of comparative statistical analysis methods, based on estimated population variances determined through calculation of scores that were historically observed in the sample. The estimated population variance was used as the basis of comparative analysis to test the hypotheses. A comparative ex post facto research design is appropriate to describe the influence between variables when the mean and variance of the subject population is unknown (Aron, Aron, & Coups, 2009).

Grinyer and Lyon (1989) demonstrated the relevance of applied research using historical financial data to improve accounting practices consistent with agency theory. Various social factors influence financial decisions. According to Chapin (1946), an ex post facto research methodology could be used by researchers to mitigate the effect of social factors on empirical data. Royal Canadian Navy Logistics Officer Qualification Board results, which were attained by military personnel, present potential research complexities in studying a protected population. This ex post facto design mitigates the requirement to sample protected individuals and builds upon previous research findings (Grinyer & Lyon, 1989; Chapin, 1946). According to Grinyer and Lyon (1989), the ex

post facto design of this research is appropriate for a comparative study that will evaluate historical qualification results and annual financial deviations within the Royal Canadian Navy.

Variables

The independent variables in the this study are (a) Royal Canadian Navy Logistics Officer Qualification Board results, and (b) nature of military operation. The dependent variable was (c) Her Majesty's Canadian Ships' fiscal year-end financial deviation from the planned operational budgets. Variable (a) was measured continuously using the recorded historical percentages. Variable (b) was measured categorically based on deployment relationship with U.S. or other nations. Variable (c) was measured continuously using the recorded historical percentage deviations between planned and actual performance results (Cooper & Schindler, 2002; Leedy & Ormrod, 2009).

Table 6: Table of Research Variables

Variable	Type	Level of Measurement
RCNLOQB	Independent	Ratio
Nature of Military Operation	Independent	Nominal
Annual Financial Deviation	Dependent	Ratio

Sampling Frame

Based on historical RCNLOQB results, the sample for this non-experimental study will be used to compare the differences in historical financial deviation records from HMC ships that have deployed on military operations in Afghanistan between 2000 and 2010. All Royal Canadian Navy Logistics Officers are responsible for financial

management at sea; however, the Royal Canadian Navy Logistics Officer Qualification Board is designed to certify Logistics Officers to perform this task during adverse and intense operational conditions. The purposive sample was selected because job performance in this operational paradigm is considered indicative for inferring expected outcomes within the remainder of the population (Cooper & Schindler, 2002; Leedy & Ormrod, 2009). In this study an oversampling beyond the 0.05 level of statistical significance was used to conduct an analysis of n=200 from results recorded between 2000 and 2010. Based on a t test of linear bivariate regression, a sample size of 164 would achieve sufficient statistical power of 0.95 with a significance level of 0.05 based on an observed positive correlation in the slope of differences in financial deviations based on RCNLOQB results. The type one error probability of inadvertently rejecting the null hypothesis by t testing a sample of this n=164 would be very small. Purposeful oversampling is being used to increase confidence in the estimates because of the lack of previous statistical data regarding the variance of the population. Increasing the purposive sample size will mitigate limitations of non-probability sampling and permit statistical inference for future performance outcomes. Royal Canadian Navy Logistics Officer Qualification Board results in the top percentile are expected to have a decreased degree of financial budget deviation than Royal Canadian Navy Logistics Officer Qualification Board results in the lower percentile that are expected to have an increased degree of financial budget deviation. Observed differences in financial deviation results are expected between categories of military operations based on RCNLOQB scores.

Appropriateness of Design

According to Chapin (1946), ex post facto experimental design is an appropriate method of comparatively evaluating presently observed effects based on previously collected information or observed outcomes. Comparative analysis is useful when the mean and variance of the population are unknown and must be estimated from the sample (Aron, Aron, & Coups, 2009). The Royal Canadian Navy has been employing Logistics Officers at sea since its inception. In over the last decade, from 2000, Royal Canadian Navy Logistics Officer Qualification Board results have been the determining factor in granting certification for Royal Canadian Navy Logistics Officers at sea. Within the observation period of 2000-2010, deviations in annual financial budgets have been consistently reported by RCN Logistics Officers serving in HMC ships. The reported deviations are subject to the financial management effectiveness of the incumbent RCN Logistics Officer, who must have attained a favorable RCNLOQB result prior to accepting their appointment. The concept of operation within the RCN prescribes that RCN Logistics Officers in Her Majesty's Canadian Ships received Royal Canadian Navy Logistics Officer Qualification Board results as a prerequisite certification prior to assuming positions at sea. A non-experimental, ex post facto research design enables a comparative analysis of differences in historical annual budget deviations based on RCNLOQB results and the categorized nature of military operations that the HMC ships were engaged in to infer future performance outcomes (Chapin, 1946; Cooper & Schindler, 2002; Leedy & Ormrod, 2009). The specific categories of military operations have been developed for this study based on the various conventional roles that the Canadian Armed Forces has fulfilled in expeditionary operations. Certain national

military operation constructs, such as unilateral combatant were not included in this study because they are either contrary to Canadian political culture or atypical for conventional western military operations. The categories have been limited to those that were actually observed during the 2000-2010 period.

Royal Canadian Navy Logistics Officers Qualification Board results are the identified population of the proposed study. A comparative analysis is appropriate for the planned research outcomes based on the influence of RCNLOQB results on the differences between annual financial deviations based on the nature of military operations in which the HMC ship was involved. A non-experimental ex post facto research design is appropriate to conduct comparative analysis between the independent and dependent variables. Co-variational relationships emerging from the comparative analysis between the dependent and independent variables, observed in the non-experimental ex post facto research sample are attributable to the research population (Chapin, 1946). This non-experimental ex post facto study has comparatively analyzed the influence of training evaluation results on differences between job performance results to statistically infer future performance outcomes based on RCNLOQB results and the nature of military operations. The resultant finding from this analysis contribute to the limited research in the area of training evaluation and financial management performance within the military environment. The findings could offer a foundation for future studies surrounding causal factors influencing the observed outcomes.

Research Questions

The following are the research questions that will guide the investigation and their corresponding hypotheses:

RQ 1: Do Royal Canadian Navy Logistics Officer Qualification Board results significantly effect financial expenditure deviation within Her Majesty's Canadian Ships?

$H1_0$: Based on RCNLOQB results, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in recent operations between 2000 and 2010.

$H1_a$: Based on RCNLOQB results, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in recent operations between 2000 and 2010.

RQ 2: Do Royal Canadian Navy Logistics Officer Qualification Board results significantly effect financial expenditure deviation within Her Majesty's Canadian Ships that deployed in Canada's military operations with the United States?

$H2_0$: Based on RCNLOQB results, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in Canada's military operations with the United States, as observed during Operation ALTAIR.

$H2_a$: Based on RCNLOQB results, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in Canada's military operations with the United States, as observed during Operation ALTAIR.

RQ 3: Do Royal Canadian Navy Logistics Officer Qualification Board results significantly effect financial expenditure deviation within Her Majesty's Canadian Ships that deployed in US-led military operations with multiple nations?

$H3_0$: Based on RCNLOQB results, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in US-led military operations with multiple nations, observed during Operation APOLLO.

$H3_a$: Based on RCNLOQB results, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in US-led military operations with multiple nations, observed during Operation APOLLO.

RQ 4: Do Royal Canadian Navy Logistics Officer Qualification Board results significantly effect financial expenditure deviation within Her Majesty's Canadian Ships that deployed in a multinational campaign?

$H4_0$: Based on RCNLOQB results, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in a multinational campaign, observed during Operation SAIPH.

$H4_a$: Based on RCNLOQB results, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in a multinational campaign, observed during Operation SAIPH.

RQ 5: Does the nature of the military operation significantly effect financial expenditure deviation within Her Majesty's Canadian Ships?

$H5_0$: Based on the nature of operation, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships.

$H5_a$: Based on the nature of operation, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships.

Population

The research population was Logistics Officers responsible for financial management within the Canadian Forces. A subset of that broader population is members of the RCN and the annual financial budget records from HMC ships paired with the Royal Canadian Navy Logistics Officer Qualification Board results. Military operations within the Canadian Armed Forces are conventionally conducted based on environmental affiliation with an additional joint category. Logistics officers, however, are professionally developed based on their environmental affiliation and are anticipated to have distinct performance outcomes that are similar between environments while concurrently unique to their specific affiliation. The financial management results and training performance records are identifiable as paired scores within Her Majesty's Canadian Ships that have deployed in support of Canada's military operations in Afghanistan as part of Operations APOLLO, ALTAIR, or SAIPH. The historical records from the research population are public information retained by the Canadian Armed Forces. The Director of Navy Logistics, located within RCN headquarters, specifically retains score pairs and other information specific to the population subset. This non-experimental ex post facto study does not involve any interaction or data collection from human subjects. Approval from the Canadian Department of National Defence (DND) was received (Annex A and Annex C) to use premises and access the historical records required for this comparative study. The population records will be accessed through secure electronic means on the DND Defence Wide Area Network (DWAN).

Informed Consent

In this study, Royal Canadian Navy Logistics Officer Qualification Board results have been sampled and analyzed from historical records retained by the Royal Canadian Navy. The research data and comparative analysis was aggregated and presented in manner that protected the identity of those persons whose records were used in the research sample. According to Canadian legislation detailed in the Access to Information Act, access to records from federal departments and agencies must be presented in writing with sufficient clarity and specificity to permit internal personal to reasonably locate precise information (Department of Justice, 1985). The Access to Information Act both grants access to specific information and protects the rights of individuals who may be directly or inadvertently identified in the event of released information. In accordance with the Access to Information Act, and internal DND social science research, institutional permission has been received (Annex A and Annex C) to access historical records for the purpose of this study. Individual performance was not presented in the research findings to further protect individual interests. Financial deviations were aggregated and reported based on the nature of the mission to prevent the potential attribution of RCNLOQB results to any particular individual.

Implicit, individual consent to access the public, historical records is supported by Canadian, federal legislation. According to Christensen, Johnson, and Turner (2011), the American Psychology Association Standard 8.05, in conjunction with federal regulation supports the possibility of dispensing with explicit informed and expressed individual consent. It is appropriate to dispense with explicit informed individual consent based on the nature of this research design. This non-experimental ex post facto study will not

involve any interaction or data collection from human subjects, informed consent is not pertinent.

Confidentiality

Aggregating research findings in accordance with the research questions will ensure the non-attribution of unique RCNLOQB results to individuals, and protect confidentiality. Neither unique HMC ships, nor the corresponding Royal Canadian Navy Logistics officer will be specifically identified in the research results to prevent the direct or deduced identification of relevant individuals. Although access to the sample is granted through Annex A, Annex C, and federal legislation (Department of Justice, 1985), the legislation concurrently protects the rights of the relevant individual, and prohibits the contravention of individual privacy (Department of Justice, 1985a).

Geographic Location and Data Collection

Data regarding the research sample is located in Ottawa, Ontario, Canada at the Royal Canadian Navy maritime staff headquarters. Duplicate copies of RCNLOQB results are stored in either Maritime Pacific or Maritime Atlantic headquarters, depending on where the particular RCNLOQB was convened. The population is located in Canada. Financial information regarding Her Majesty's Canadian Ship's fiscal year-end records are retained by the Royal Canadian Navy, Command Comptroller, and the Canadian Joint Operations Command headquarters, both located in Ottawa, Ontario, Canada.

The military is a protected research class. Individuals were not used in this study, to further protect and minimize their research exposure. The nature of this study was related to the influence of historical qualification board results on differences in financial deviation based on RCNLOQB results. The influence of board results on the reported

differences between financial deviation was conducted through analysis of existing historical records. This non-experimental ex post facto study did not involve any interaction or data collection from human subjects.

Historical data was provided by the Director of Navy Logistics through electronic records and verified by comparison with original source documents when available. The sender, Director of Navy Logistics (position 3-2) transmitted electronic data directly to the researcher. The researcher personally collect all historical data. Electronic data has been encrypted and digitally signed using serialized personnel encryption keys and protocols provided by the Department of National Defence. Data analysis was conducted in the secure Defence Wide Area Network (DWAN). Only aggregate research results were extracted from the DWAN environment to protect data integrity and prevent indirect personnel attribution/association with historical qualification results.

Data Security

Research data was stored on a secure DWAN server and encrypted using a unique personnel identifier token and password combination. Electronic data used in this study was considered sensitive and accordingly designated to level *Protected B* (Department of Justice, 1985; Department of Justice, 1985a), to protect against any possibility of grave personnel injury such as loss of reputation or competitive advantage. No personally identifiable data were included in the data. Paper files will be retained in Level 2 security containers and secured with reinforced Greenleaf locking mechanisms. The data will be deleted and destroyed by the researcher 3 years after the publishing of the dissertation.

Data Analysis

Randomization was maintained in this non-experimental study by chronologically grouping Royal Canadian Navy Logistics Board results in the order in which they occurred, without external manipulation of the historical data (Christensen, Johnson, & Turner, 2011). Respective Logistics Officers were randomly assigned to challenge the qualification board based on their homeport, and had no direct influence over the composition of timing of the boards. The population was not assigned to deploying HMC Ships based on their board results. In this study, the sample was warships grouped by nature of the military operation based on the original assignment, without experimental manipulation. Fiscal year-end, budgeted, financial position deviations for Her Majesty's Canadian Ship were statistically controlled and entered as the originally observed percentage deviations from the plan.

The RCNLOQB required a minimum score of 70% to successfully attain qualification to conduct logistics support within HMC ships on military operations. A ratio score of 70% was established as the low-value threshold for the independent variable. Univariate descriptive statistical analysis have been used in this study to describe the distribution of the independent variable, including the mean, median, and mode for the qualification board scores. The nature of military operations has been sub-divided into four types and were categorically described for comparative analysis. The ratio values of the annual financial deviations were plotted as percentage values of variance from their budget ceilings to a maximum and minimum of +/- 0.5%. Linear regression testing has been used in this study to infer the statistical confidence interval of the influence of the independent variable of RCNLOQB on differences between the

annual financial deviations of the dependent variable. *T*-testing was also be conducted to ascertain if there were any statistically significant differences in the regression outcomes introduced by the nature of the military operations independent variable.

The data analysis commenced with a calculation of the mean and variance of the RCNLOQB results and financial deviation outcomes for the sample. This analysis permitted the estimation of the variance for the population. Prior to conducting comparative analysis of the effect of RCNLOQB results on financial deviations, categorized by military operations, the assumed association between RCNLOQB performance and financial deviation outcome has been rejected and described in chapter four. H1,H2, H3, and H4 were tested through a linear bivariate regression correlation test to determine the existence of association between the RCNLOQB and financial deviation score pair (Figure 2). The ratio level of measure for RCNLOQB and financial deviation results enabled a reliable comparison of differences for the purpose of *t*-testing. H2, H3, and H4 were each further tested through a comparison of their mean financial deviation of the sample with the mean financial deviation for the entire sample to determine whether the significance of differences between means is effected by the nature of military operation. Comparison against the sample is consistent with the inferential statics practices to determine effect-size based on the estimated population variance (Aron, Aron, & Coups, 2009). H5 was analyzed through linear bivariate regression using two-tailed *t*-testing of the coefficients of correlation for the three couplets of operations (e.g. – ALTAIR to APOLLO, ALTAIR to SAIPH, and APOLLO to SAIPH) calculated in response to the hypotheses associated with Research Questions 2-4 to describe the effect of military operations categories on differences in financial deviation outcomes.

Validity and Reliability

In general terms, validity is observed when evidence directly relates to the planned interpretation of study results in the proposed purpose (Creswell, 2012). Validity increases as the relationship between the evidence and the intended interpretations decreases in separation Cooper & Schindler, 2002; Leedy & Ormrod, 2009). Experimental research controls and manipulates variables to isolate and explain causation relationship. Non-experimental research studies the causation relationship between independent variables on dependent variables based on a structured analysis of historical observations, and hypothetical explanations (Christensen, Johnson, & Turner, 2011). According to Christensen, Johnson, and Turner, (2011), reliability refers to evaluation instrument consistency and stability. Research findings are reliable when the same scores are observed during subsequent repetitions of the evaluation instrument. The intent of this study was to examine the influence of RCNLOQB results on the differences in financial deviations based on the nature of military operations through comparative analysis. The pragmatic construct of analyzing the Royal Canadian Navy's financial management role in specific types of operations involving Afghanistan over the last decade through a non-experimental, post ex facto study of data gathered over the ten year conflict enhanced the validity and reliability of the study.

Internal Validity

According to Christensen, Johnson and Turner (2011) internal validity is described as the inference that the independent and dependent variables share a relationship, which may enable the description or prescription of causality. The construct validity of this comparative ex post facto design has increased the statistical conclusion

validity of the results by eliminating the potential for independent variable manipulation. The controlled nature of this research design ensures subject research blindness in an unobtrusive method by analyzing historical observations. However, the internal validity of the statistical inference in limited to the comparative influence of the independent variable on the differences between the dependent variable results based on the nature of military operations. According to Leedy and Ormrod (2009), the nature of this quantitative ex post facto comparative design will decrease threats to internal validity (Neuman, 2005) and increase the extent to which the collected data will inform the influence of the independent variable on the differences in the dependent variables (Deutsch, 1985). Creswell (2012), discussed researcher bias as an extent threat to internal validity. Cojanu's (2007) research in the field of workforce evaluation determined that additional external individuals involved in either workforce development or economic development, could possess sufficient corporate capital to influence performance outcomes. The design of this study has mitigated performance evaluation research threats internal validity by isolating the potential influence of internal actors' perspective on data integrity.

External Validity

According to Leedy and Ormrod (2009), external validity increases as study results have expanded applicability in a general context beyond the context of the study itself. An ex post facto research design affords the advantage of studying real-life observations in a controlled non-experimental environment. The external validity of this study is increased by the size of its representative sample, and the comprehensive ten-year observation period, which summarizes Canadian Forces' combat operations in

Afghanistan and thereby increases the precision of the computation index (Chapin & Stryker, 1950). However, design of this research study limits external validity beyond the statistical inference of the analyzed variables. The ex post facto nature of this research design has mitigated threats to external validity related to a lack of randomness or subject bias (Lord, 2010). External validity is enhanced by the replicable nature of the study. Conclusions resultant from this study, presented in chapter five, might be repeated in an experimental, real-time environment to determine validity. Statistical inferences derived from this study may be tested in a non-experimental, comparative study that analyzes the same variables. The dynamic nature of military operations is a threat to external validity that adversely effects test replication. Business decisions related to external inputs that were experienced during operations can neither be isolated nor confidently repeated. Causal relationships between the independent and dependent variables may be threatened by sample interpretation of unknown external stimuli that occur normally during military operations (Perry, 2008). Examining a representative sample of missions related to the same international conflict might produce generalizations across the population and reduce the military operation threat to external validity factor (Christensen, Johnson & Turner, 2011). The purposive non-probability sampling proposed in this study decreased external validity, equating the sample to the population will increase external validity and mitigate this threat to external validity.

Summary

A quantitative, non-experimental ex post facto study was used to compare the influence of historical qualification board results on differences in financial deviation based on RCNLOQB results in Her Majesty's Canadian Ships based on the nature of

their operations in support of the Canadian Armed Forces' efforts during the war in Afghanistan. This research method and relevant considerations were described in this chapter. Additionally, this chapter includes a descriptive summary of the study population, sample, validity and data analysis. The information provided in this chapter explains the appropriateness of a non-experimental ex post facto research method for comparatively determining the influence between military performance evaluation results and differences in financial management results based on the nature of military operations.

Chapter 4

Results

Chapter 3 provided an overview of the research methodology that was used in this non-experimental ex post facto study. The statistical analysis performed during this study to answer the research questions presented in chapter 1 will be reported and described in this chapter to support the acceptance or rejection of the null hypotheses of this quantitative study. Calculation of the mean and standard deviation of the RCNLOQB results and financial deviation outcomes for the sample permitted the estimation of the variance for the population. Prior to conducting comparative analysis of the effect of RCNLOQB results on financial deviations, categorized by military operations, the assumed association between RCNLOQB performance and financial deviation outcome has been rejected and described in this chapter. Linear bivariate regression correlation tests were used to determine the existence of association between the RCNLOQB and financial deviation score pair (Figure 2). The ratio level of measure for RCNLOQB and financial deviation results enabled a reliable comparison of differences for the purpose of *t*-testing.

Research Instrument

In this study, statistical analysis was conducted through the application of IBM SPSS Statistics, inferential statistics software. Information collected for this ex post facto study was provided in Excel tables for financial and RCNLOQB results. The data were incorporated into SPSS computer databases for the purposes of statistical analysis.

Participants

Within the Royal Canadian Navy approximately 10 Logistics Officers are certified through the RCNLOQB in both Maritime Pacific and Maritime Atlantic Headquarters each year. For the research target period of 2001-2010 it was anticipated that approximately 200 Royal Canadian Logistics Officers would have successfully challenged the RCNLOQB and been subsequently available for employment at sea aboard one of HMCS during expeditionary operations outside of Canada. The study included all available Royal Canadian Navy Logistics Officer training files between 2000 and 2010. As a result of employment terminations due to medical, retirement, or release some files were inaccessible. One hundred and eighty five participants were sampled, and produced 14 unusable records, therefore *n* was adjusted to 171 files, which sufficiently satisfied the requisite minimum degrees of freedom of 164, described in Chapter 2.

Financial deviation data was provided by the RCN for Operations ALTAIR, APOLLO, SAIPH, and HESTIA. Operation HESTIA was Canada's humanitarian assistance contribution to the earthquake relief effort in Haiti. The nature of this study is to evaluate differences in the effects of RCNLOQB results on financial deviations based type of on military operations as observed in Afghanistan. The humanitarian (non-combat) nature of Operation HESTIA, and it area of operation in Haiti, excluded it from inclusion in this study. The main objective of the study was to examine the influence of RCNLOQB results on the differences between annual financial deviations based on the nature of military operations in which the HMC ship was involved. Consistent with this aim, five research questions with associated hypothesis were tested:

RQ 1: Do Royal Canadian Navy Logistics Officer Qualification Board results significantly effect financial expenditure deviation within Her Majesty's Canadian Ships?

$H1_0$: Based on RCNLOQB results, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in recent operations between 2000 and 2010.

$H1_a$: Based on RCNLOQB results, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in recent operations between 2000 and 2010.

RQ 2: Do Royal Canadian Navy Logistics Officer Qualification Board results significantly effect financial expenditure deviation within Her Majesty's Canadian Ships that deployed in Canada's military operations with the United States?

$H2_0$: Based on RCNLOQB results, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in Canada's military operations with the United States, as observed during Operation ALTAIR.

$H2_a$: Based on RCNLOQB results, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in Canada's military operations with the United States, as observed during Operation ALTAIR.

RQ 3: Do Royal Canadian Navy Logistics Officer Qualification Board results significantly effect financial expenditure deviation within Her Majesty's Canadian Ships that deployed in US-led military operations with multiple nations?

$H3_0$: Based on RCNLOQB results, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in US-led military operations with multiple nations, observed during Operation APOLLO.

$H3_a$: Based on RCNLOQB results, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in US-led military operations with multiple nations, observed during Operation APOLLO.

RQ 4: Do Royal Canadian Navy Logistics Officer Qualification Board results significantly effect financial expenditure deviation within Her Majesty's Canadian Ships that deployed in a multinational campaign?

$H4_0$: Based on RCNLOQB results, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in a multinational campaign, observed during Operation SAIPH.

$H4_a$: Based on RCNLOQB results, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in a multinational campaign, observed during Operation SAIPH.

RQ 5: Does the nature of the military operation significantly effect financial expenditure deviation within Her Majesty's Canadian Ships?

$H5_0$: Based on the nature of operation, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships.

$H5_a$: Based on the nature of operation, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships.

Prior to answering H2-H5, the analysis of the effect of RCNLOQB results on the differences of financial deviations, categorized by military operations, have been

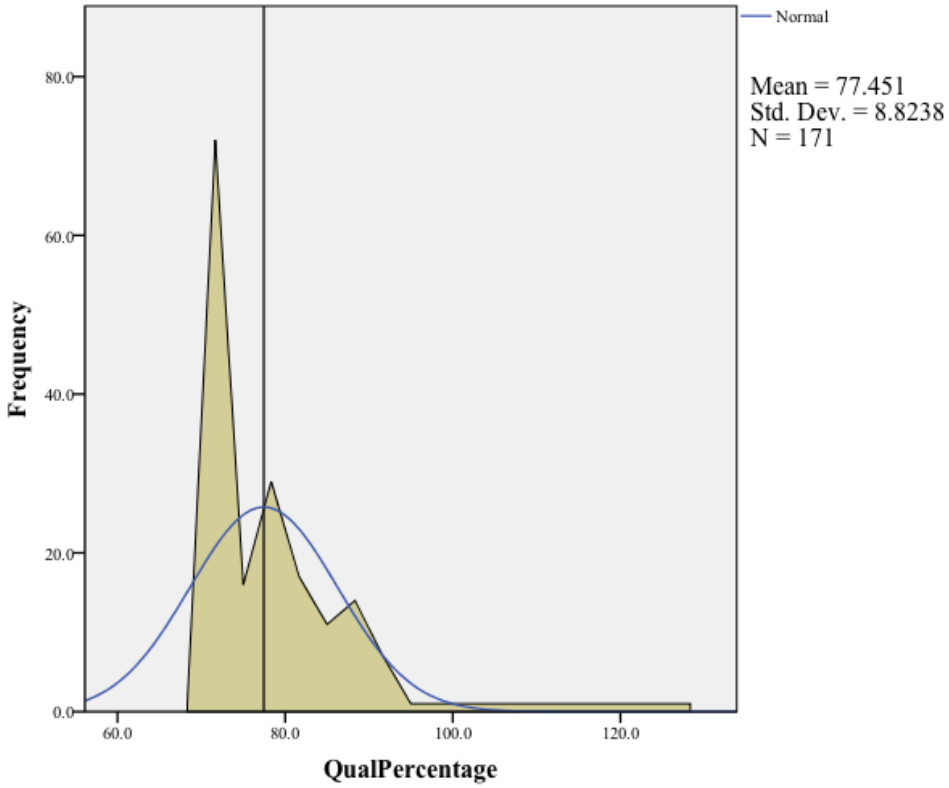
provided for the overall sample, irrespective of military operation category to present the association between RCNLOQB performance and financial deviation outcome. The results for the overall sample will be expressed through a histogram to identify the mean and standard deviation for the population. Linear bivariate correlation tests will provide information regarding the association of population score pairs. Inferential statistics *t*-testing will be used to compare differences between score pair results.

The Sample

Description of the Sample

The normal distribution for RCNLOQB results, frequency, including mean, and standard deviation are presented in Figure 7. The study sampled 171 Royal Canadian Navy Logistics Officer training files. The RCNLOQB passing grade of 70% was closely related to the mean grade of 77.45% for the sample. The standard deviation was 8.82, with a median score of 76%. The range of scores was distributed across 58.4%, with the minimum score of 69.4% and maximum score of 127.8%.

Figure 7: RCNLOQB Normal Distribution Curve

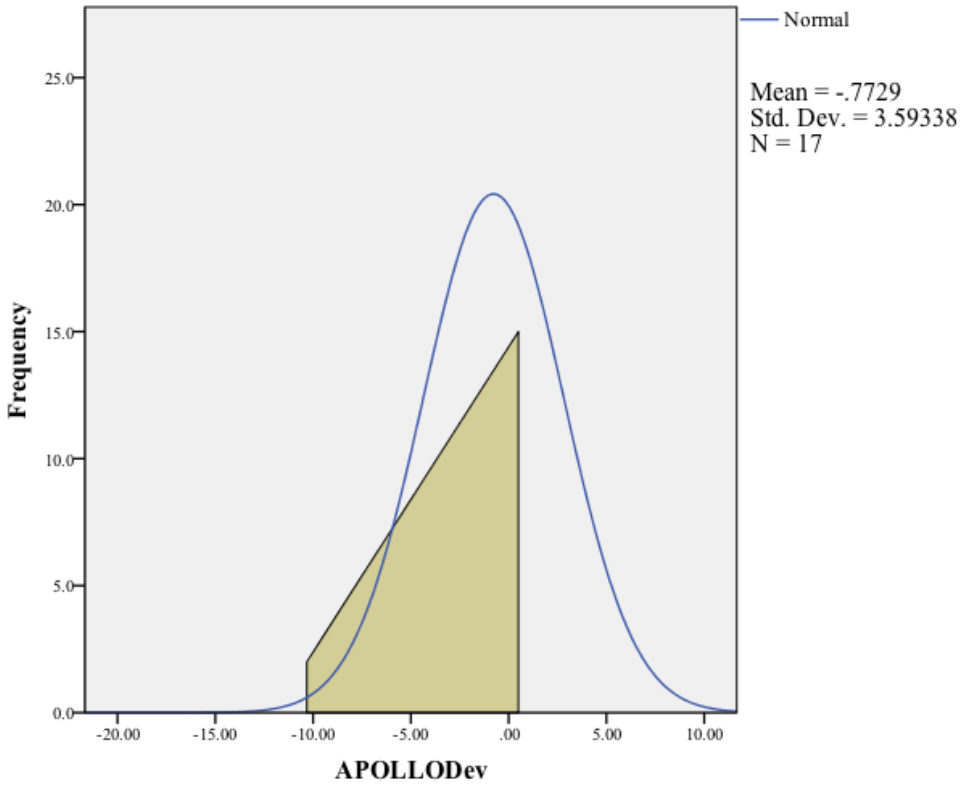


In 2005, RCNLOQB were scored through a time-based questioning approach, with an unlimited number of questions versus scoring based on the standard 10 questions asked to complete the board. As a result of this approach, RCNLOQB candidates were permitted to receive additional questions depending on the speed with which the standard questions were completed. In the event that a participant received more questions, the points allocated by the scoring board were added to the final score attained, but did not adjust the original threshold, thereby making it possible to attain a final score greater than 100%.

The normal distribution for Operation APOLLO financial deviation results, frequency, mean, and standard deviation are presented in Figure 8. The study sampled 171 Royal Canadian Navy Logistics Officer training files, producing 17-paired scores.

The optimal financial deviation ratio between planned and actual budget expenditures of +/- 0.5% was closely related to the calculated mean deviation of -0.7729%, for the Operation APOLLO sample group. The standard deviation was 3.59, with a median score of 0.5%. The range of scores was distributed across 10.82%, with the minimum score of -10.32% and maximum score of 0.50%.

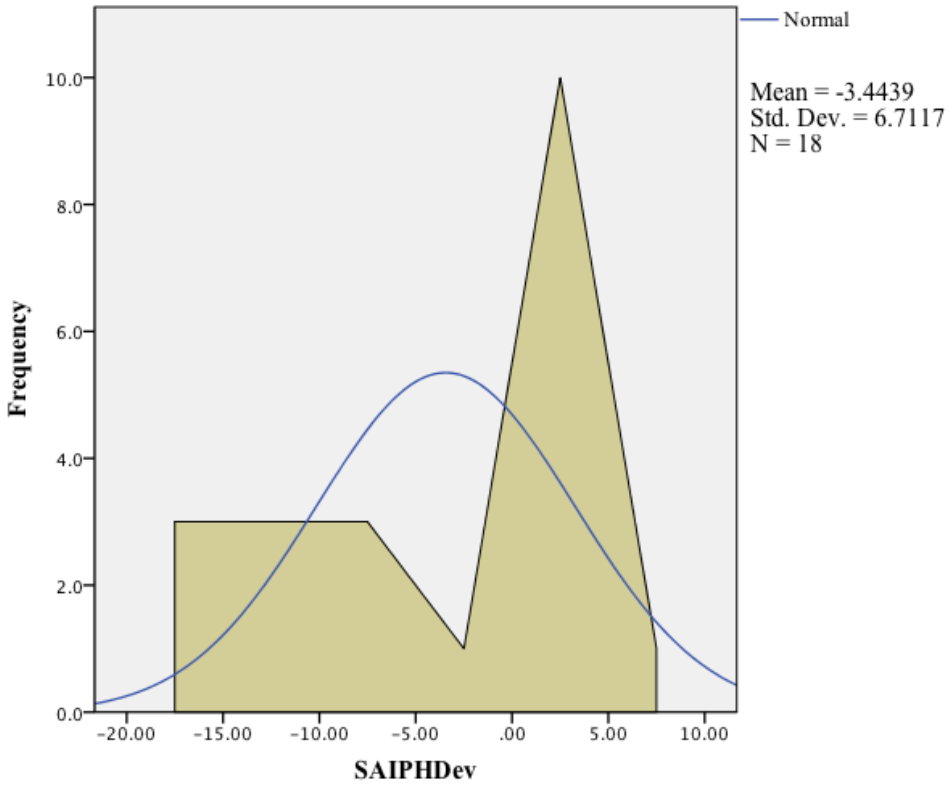
Figure 8: Operation APOLLO Financial Deviation Normal Distribution Curve



The normal distribution for Operation SAIPH financial deviation results, frequency, mean, and standard deviation are presented in Figure 9. The study sampled 171 Royal Canadian Navy Logistics Officer training files, producing 18-paired scores. The optimal financial deviation ratio between planned and actual budget expenditures of +/- 0.5% was not closely related to the calculated mean deviation of -3.44% for the

population. The standard deviation was 6.71, with a median score of 0.25%. The range of scores was distributed across 22.73%, with the minimum score of -15.63% and maximum score of 7.10%.

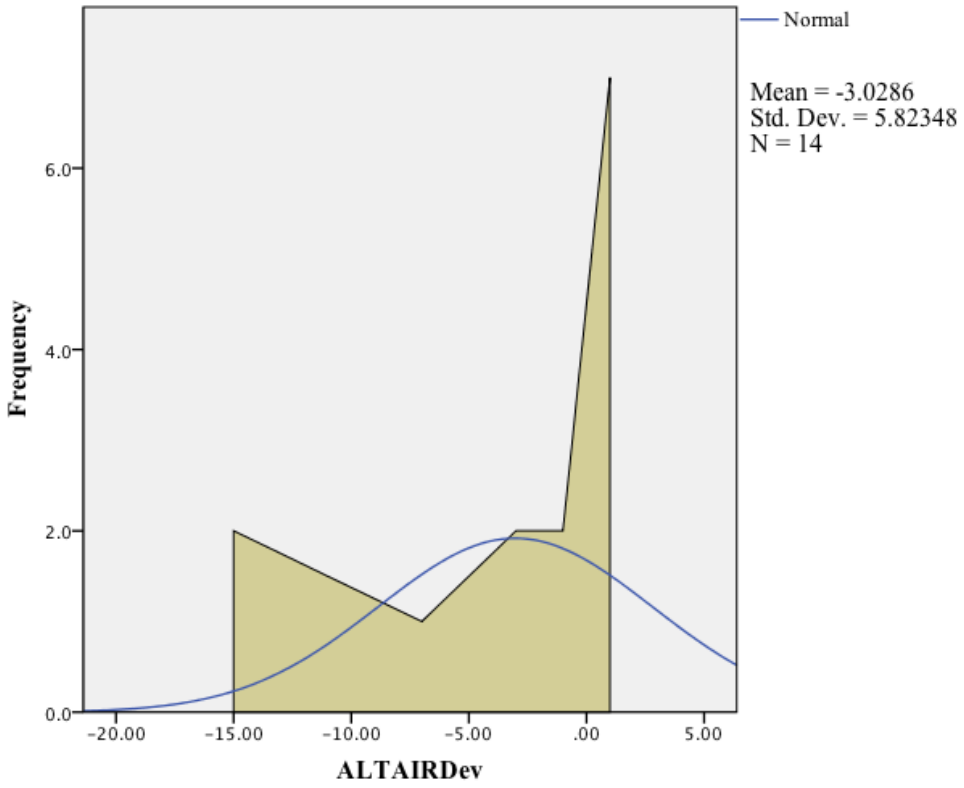
Figure 9: Operation SAIPH Financial Deviation Normal Distribution Curve



The normal distribution for Operation ALTAIR financial deviation results, frequency, mean, and standard deviation are presented in Figure 10. The study sampled 171 Royal Canadian Navy Logistics Officer training files, producing 14-paired scores. The optimal financial deviation ratio between planned and actual budget expenditures of +/- 0.5% was not closely related to the calculated mean deviation of -3.03% for the population. The standard deviation was 5.82, with a median score of 0.450%. The range

of scores was distributed across 16.13%, with the minimum score of -15.63% and maximum score of 0.50%.

Figure 10: Operation ALTAIR Financial Deviation Normal Distribution Curve



Description of Paired Score Correlation between RCNLOQB Score and Financial Deviation

The following section will present figures of inference, and tables of descriptive statistics and correlation of the RCNLOQB scores and financial deviations by military operation. The degree of statistical significance observed in the observed differences in coefficients of correlation, and covariance between paired scores and mission couplets will be used to accept or reject the research hypothesis for each research question, supported by its associated figure and tables.

RQ 1: Do Royal Canadian Navy Logistics Officer Qualification Board results significantly effect financial expenditure deviation within Her Majesty's Canadian Ships?

$H1_0$: Based on RCNLOQB results, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in recent operations between 2000 and 2010.

$H1_a$: Based on RCNLOQB results, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in recent operations between 2000 and 2010.

Figure 11: Linear Regressions and Coefficient of Determination of RCNLOQB and Military Operation Score Pairs

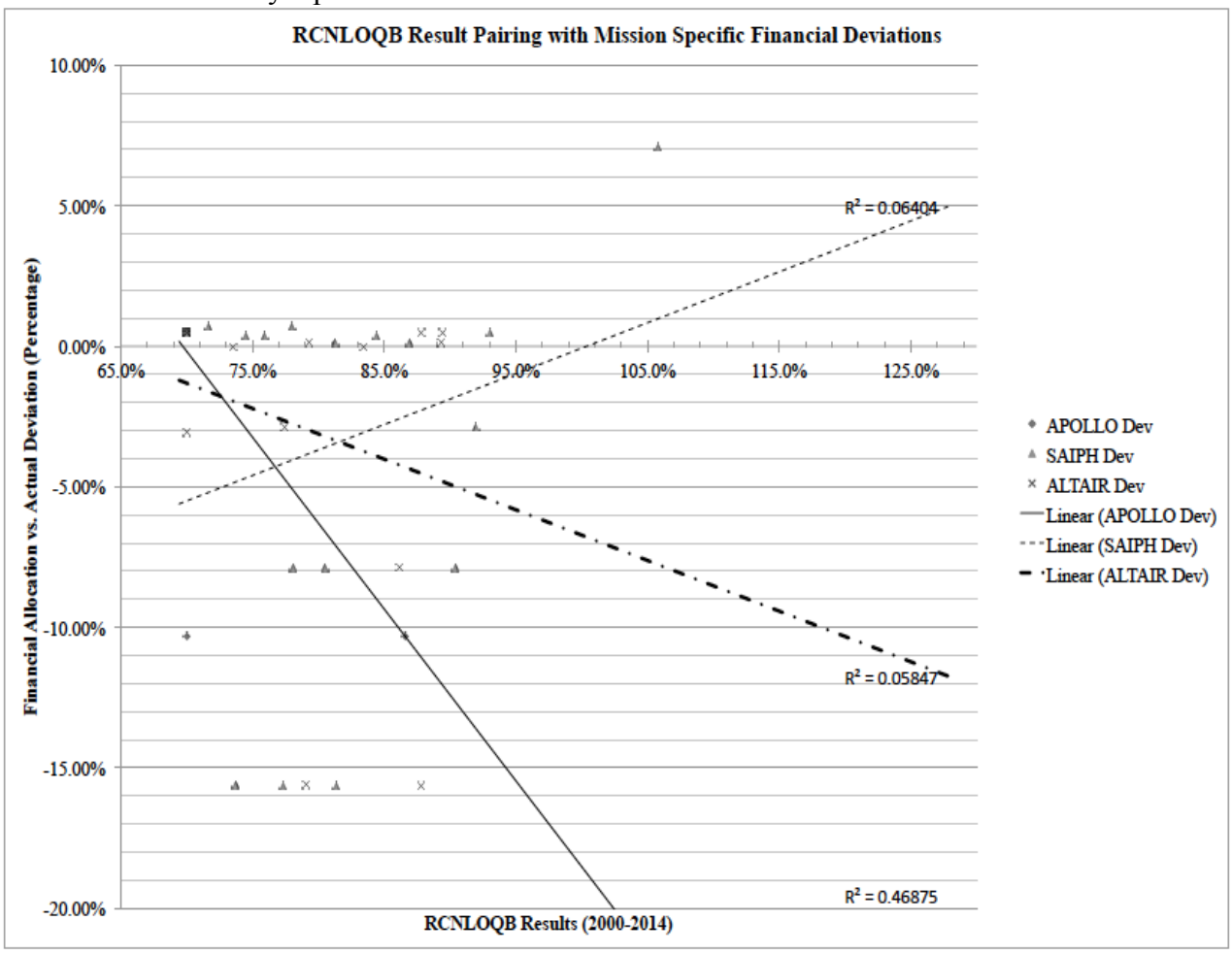


Table 12: Descriptive Statistics of RCNLOQB and Military Operation Paired Scores

		Mean	n	Std. Deviation	Std. Error Mean
Pair 1	QualPercentage	70.976	17	4.0261	.9765
	APOLLODev	-.7729	17	3.59338	.87152
Pair 2	QualPercentage	79.521	14	7.8157	2.0888
	ALTAIRDev	-3.0286	14	5.82348	1.55639
Pair 3	QualPercentage	81.383	18	9.3765	2.2101
	SAIPHDev	-3.4439	18	6.71170	1.58196

Table 13: Correlation of RCNLOQB and Military Operation Paired Scores

		n	Correlation	Sig.
Pair 1	QualPercentage & APOLLODev	17	-.685	.002
Pair 2	QualPercentage & ALTAIRDev	14	-.241	.407
Pair 3	QualPercentage & SAIPHDev	18	.253	.311

Table 14: Coefficient of Correlation between RCNLOQB and Military Operation Score Pairs

		Qual Percentage	APOLLO Dev	SAIPH Dev	ALTAIR Dev
Qual Percentage	Pearson Correlation	1	-.685**	.253	-.241
	Sig. (2-tailed)		.002	.311	.407
	n	171	17	18	14
APOLLO Dev	Pearson Correlation	-.685**	1	.b	.b
	Sig. (2-tailed)	.002		.	.
	n	17	17	0	0
SAIPH Dev	Pearson Correlation	.253	.b	1	.b
	Sig. (2-tailed)	.311	.		.
	n	18	0	18	0
ALTAIR Dev	Pearson Correlation	-.241	.b	.b	1
	Sig. (2-tailed)	.407	.	.	
	n	14	0	0	14

**. Correlation is significant at the 0.01 level (2-tailed).

b. Cannot be computed because at least one of the variables is constant.

Figure 15: RCNLOQB Score and Operation APOLLO Financial Deviation Regression Line

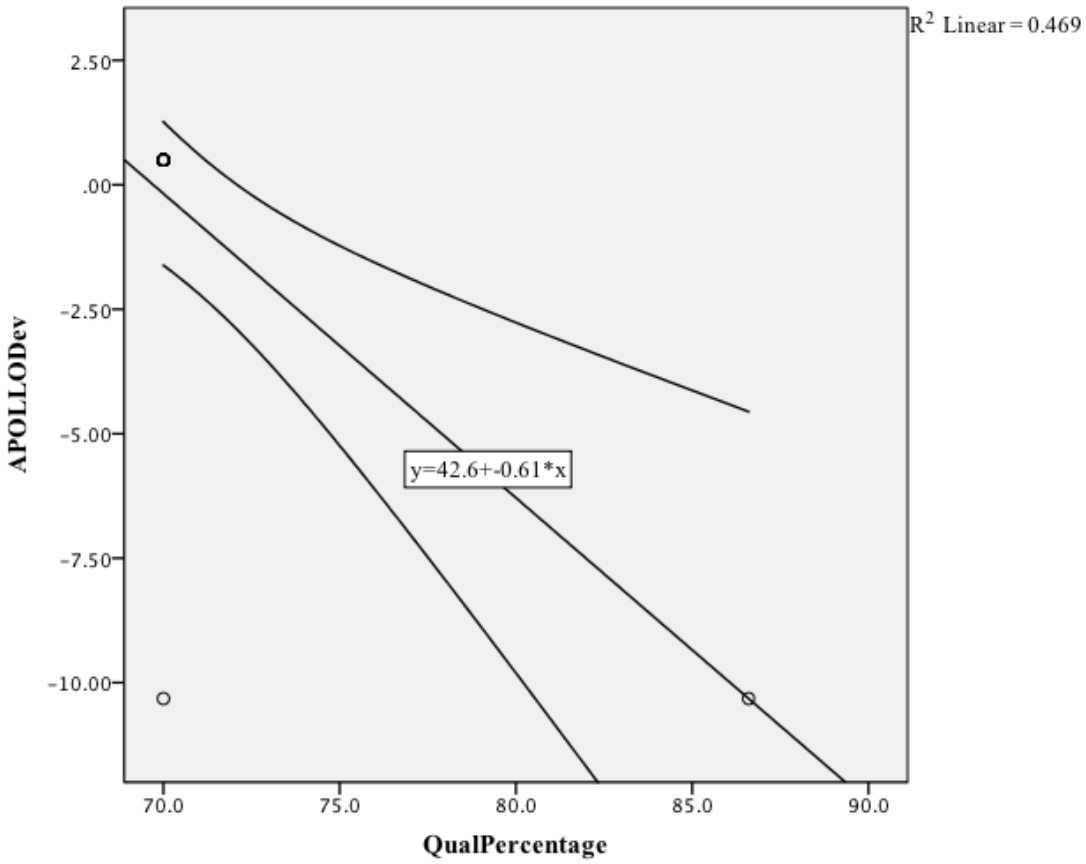


Table 16: RCNLOQB Scores and Operation APOLLO Financial Deviation Paired Scores Descriptive Statistics

		Mean	n	Std. Deviation	Std. Error Mean
Pair 1	QualPercentage	70.976	17	4.0261	.9765
	APOLLODev	-.7729	17	3.59338	.87152

Table 17: Linear Regression Analysis Coefficients for Op APOLLO Financial Deviation Paired with RCNLOQB Scores

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	QualPercentage - APOLLODev	71.74941	6.99514	1.69657	68.15284	75.34598	42.291	16	.000

Table 18: RCNLOQB Scores and Operation APOLLO Financial Deviation Paired Scores Linear Bivariate Regression Analysis

		QualPercentage	APOLLODev
QualPercentage	Pearson Correlation	1	-.685**
	Sig. (2-tailed)		.002
	n	171	17
APOLLODev	Pearson Correlation	-.685**	1
	Sig. (2-tailed)	.002	
	n	17	17

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 11 presents a linear regression summary of RCNLOQB scores paired with Operations APOLLO, SAIPH, and ALTAIR. The coefficient of determination (R^2) was included for analysis between the differences in paired score comparison. The differences presented in Figure 11 will be used to answer RQ1. An apparent and substantive difference is observable in Figure 11 between the linear regressions of each of the three paired scores, based on the nature of the military operation. A statistically significant difference was observed between the coefficients of determination in the RCNLOQB

results versus Operation APOLLO financial expenditure deviations compared with the coefficients of determination of the other two paired scores.

RQ1- $H1_0$ is rejected, a statistically significant difference was calculated using the Pearson Correlation at the 0.01 level in a two-tailed *t*-test of RCNLOQB results and financial expenditure deviation within Her Majesty's Canadian Ships that were deployed on Operation APOLLO. Table 12 presents the descriptive statistics of the paired scored. Table 13 presents coefficients and statistical significance of correlations for paired scores, which confirms the rejection of RQ1- $H1_0$. Table 14 presents the coefficient of correlation between RCNLOQB and military operation score pairs, which confirms the rejection of RQ1- $H1_0$ based on the observed difference in the coefficient of correlation for paired RCNLOQB results and financial expenditure deviations for Op APOLLO compared to operations SAIPH, and ALTAIR. The descriptive statistics of a linear bivariate regression correlation two-tailed *t*-test of RCNLOQB scores and Op APOLLO financial deviations are present in Table 17. The Person Correlation, and *t*-test degree of correlation significance for the RCNLOQB and Op APOLLO paired scores is present in Table 18.

RQ 2: Do Royal Canadian Navy Logistics Officer Qualification Board results significantly effect financial expenditure deviation within Her Majesty's Canadian Ships that deployed in Canada's military operations with the United States?

$H2_0$: Based on RCNLOQB results, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in Canada's military operations with the United States, as observed during Operation ALTAIR.

$H2_a$: Based on RCNLOQB results, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in Canada's military operations with the United States, as observed during Operation ALTAIR.

Table 19: RCNLOQB Scores and Operation ALTAIR Financial Deviation Paired Scores Descriptive Statistics

		Mean	n	Std. Deviation	Std. Error Mean
Pair 1	QualPercentage	79.521	14	7.8157	2.0888
	ALTAIRDev	-3.0286	14	5.82348	1.55639

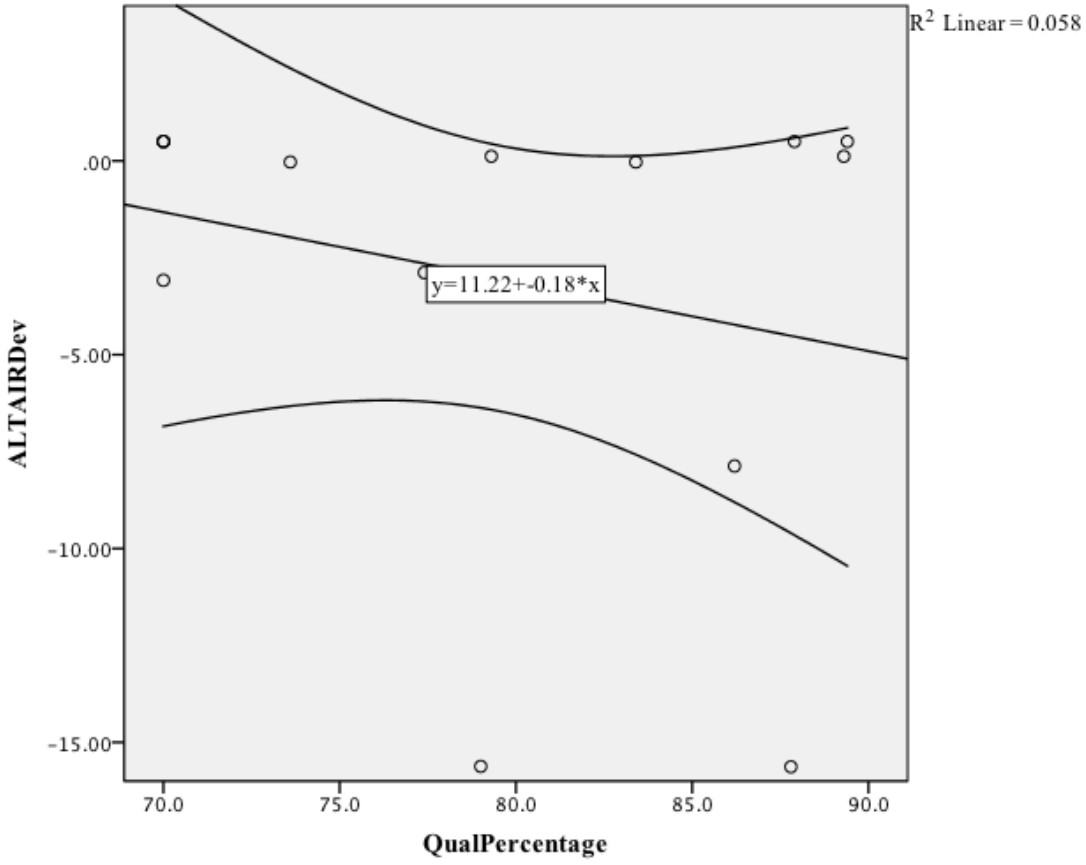
Table 20: Linear Regression Analysis Coefficients for Op ALTAIR Financial Deviation Paired with RCNLOQB Scores

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	QualPercentage - ALTAIRDev	82.55000	10.81171	2.88955	76.30750	88.79250	28.568	13	.000

Table 21: RCNLOQB Scores and Operation ALTAIR Financial Deviation Paired Scores Linear Bivariate Regression Analysis

		QualPercentage	ALTAIRDev
QualPercentage	Pearson Correlation	1	-.241
	Sig. (2-tailed)		.407
	n	171	14
ALTAIRDev	Pearson Correlation	-.241	1
	Sig. (2-tailed)	.407	
	n	14	14

Figure 22: RCNLOQB Score and Operation ALTAIR Financial Deviation Regression Line



The descriptive statistics of a linear bivariate regression correlation two-tailed *t*-test of RCNLOQB scores and Op ALTAIR financial deviations are present in Table 19.

A summary of coefficients is present in Table 20. The Person Correlation, and degree of statistical correlation significance of a two-tailed *t*-test for the RCNLOQB and Op ALTAIR paired scores is present in Table 21. A statistically significant correlation was not calculated between RCNLOQB and Op ALTAIR paired scores. Figure 22 presents the linear regression of RCNLOQB Scores and Op ALTAIR Financial Deviation.

RQ2-$H2_0$ is accepted, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in Canada's military operations with the United States, as observed during Operation ALTAIR.

RQ 3: Do Royal Canadian Navy Logistics Officer Qualification Board results significantly effect financial expenditure deviation within Her Majesty's Canadian Ships that deployed in US-led military operations with multiple nations?

$H3_0$: Based on RCNLOQB results, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in US-led military operations with multiple nations, observed during Operation APOLLO.

$H3_a$: Based on RCNLOQB results, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in US-led military operations with multiple nations, observed during Operation APOLLO.

The descriptive statistics of a linear bivariate regression correlation two-tailed *t*-test of RCNLOQB scores and Op APOLLO financial deviations are present in Table 19. A summary of coefficients is present in Table 20. The Pearson Correlation and degree of statistical correlation significance of a two-tailed *t*-test for the RCNLOQB and Op ALTAIR paired scores is present in Table 21. A statistically significant correlation was calculated between RCNLOQB and Op APOLLO paired scores. Figure 22 presents the

linear regression of RCNLOQB Scores and Op ALTAIR Financial Deviation.

RQ3-$H3_0$ is rejected, a statistically significant difference, within a 0.01 confidence level exists in financial expenditure deviation within Her Majesty's Canadian Ships deployed in US-led military operations with multiple nations, observed during Operation APOLLO.

RQ 4: Do Royal Canadian Navy Logistics Officer Qualification Board results significantly effect financial expenditure deviation within Her Majesty's Canadian Ships that deployed in a multinational campaign?

$H4_0$: Based on RCNLOQB results, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in a multinational campaign, observed during Operation SAIPH.

$H4_a$: Based on RCNLOQB results, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in a multinational campaign, observed during Operation SAIPH.

Table 23: RCNLOQB Scores and Operation SAIPH Financial Deviation Paired Scores Descriptive Statistics

		Mean	n	Std. Deviation	Std. Error Mean
Pair 1	QualPercentage	81.383	18	9.3765	2.2101
	SAIPHDev	-3.4439	18	6.71170	1.58196

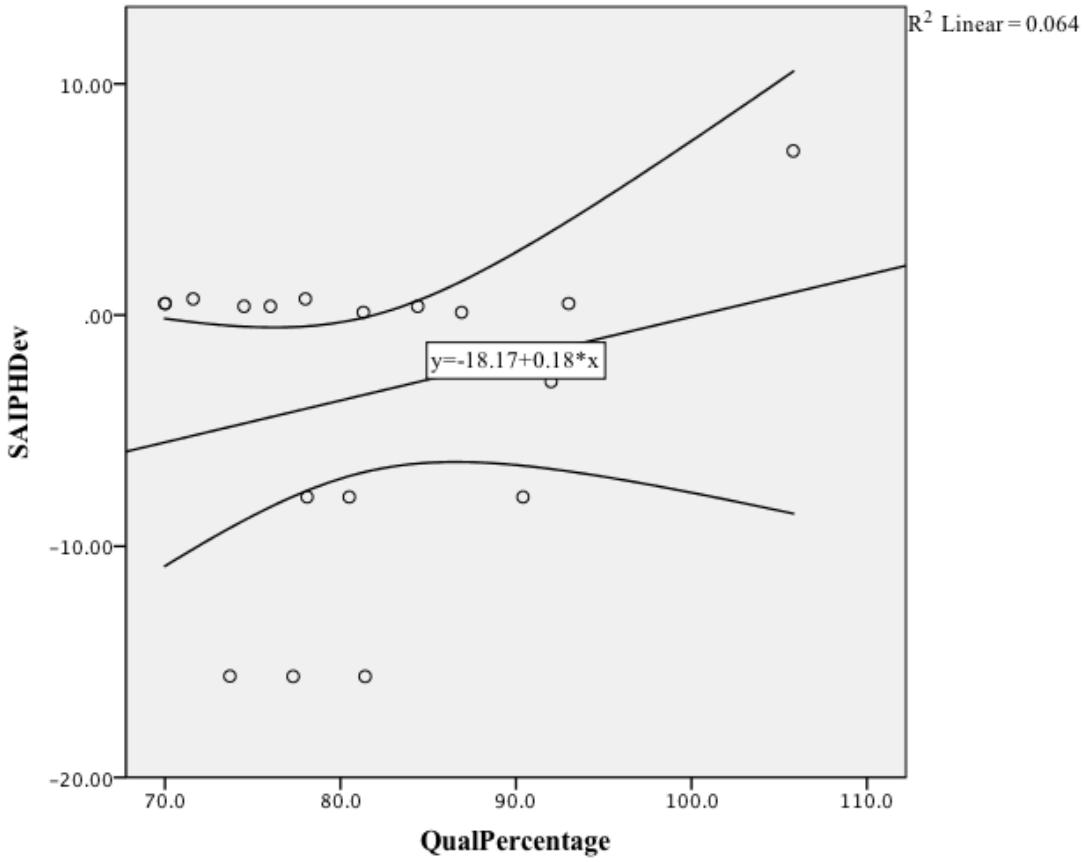
Table 24: Linear Regression Analysis Coefficients for Op SAIPH Financial Deviation Paired with RCNLOQB Scores

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	QualPercentage - SAIPHDev	84.82722	10.05677	2.37040	79.82611	89.82834	35.786	17	.000

Table 25: RCNLOQB Scores and Operation SAIPH Financial Deviation Paired Scores Linear Bivariate Regression Analysis

		QualPercentage	SAIPHDev
QualPercentage	Pearson Correlation	1	.253
	Sig. (2-tailed)		.311
	n	171	18
SAIPHDev	Pearson Correlation	.253	1
	Sig. (2-tailed)	.311	
	n	18	18

Figure 26: RCNLOQB Score and Operation SAIPH Financial Deviation Regression Line



The descriptive statistics of a linear bivariate regression correlation two-tailed *t*-test of RCNLOQB scores and Operation SAIPH financial deviations are present in Table 23. A summary of coefficients is present in Table 24. The Pearson Correlation and degree of statistical correlation significance of a two-tailed *t*-test for the RCNLOQB and Operation SAIPH paired scores is present in Table 25. A statistically significant correlation was not calculated between RCNLOQB and Operation SAIPH paired scores. Figure 26 presents the linear regression of RCNLOQB Scores and Op SAIPH Financial Deviation.

RQ4-$H4_0$ is accepted, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships deployed in Canada's military operations in a multinational campaign, observed during Operation SAIPH.

RQ 5: Does the nature of the military operation significantly effect financial expenditure deviation within Her Majesty's Canadian Ships?

$H5_0$: Based on the nature of operation, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships.

$H5_a$: Based on the nature of operation, significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships.

The linear regression lines in Figure 11 present a difference in financial deviations based on the nature of military operation. An intersection point was observed between Operation APOLLO and Operation ALTAIR at -1.5% financial deviation at a RCNLOQB score of 72%, which is outside the target financial deviation range of +/- 0.5%. A second intersection point was observed between Operation SAIPH and Operation ALTAIR at -4.2% financial deviation at a RCNLOQB score of 76%. A third intersection point was observed between Operation ALTAIR and Operation SAIPH at -3.2% financial deviation at a RCNLOQB score of 81%. Table 14 presents the RCNLOQB Scores and Military Operations Paired Samples Test, in which no statistical significance was observed between paired scores related to the type of military operation.

RQ5-$H5_0$ is accepted, no significant differences exist in financial expenditure deviation within Her Majesty's Canadian Ships based on the nature of military operation, as observed by comparing the differences between paired scores of financial deviations from Operation ALTAIR, Operation APOLLO, and Operation SAIPH.

Summary of Findings

Descriptive statistics showed that although means for operational missions scores were closely distributed around optimal values, the actual means did not conform to expected outcomes. The standard deviations for each mission were also broadly separated, resulting in large financial deviations within as little as one standard deviation from the mean. The skewed means and large standard deviations created a statistical cutoff point for measuring statistical significance that provided a high improbability of finding any statistical significance to the difference observed between RCNLOQB scores and financial deviations by mission. RQ1-$H1_0$ and RQ3-$H3_0$ were rejected, statistically significant differences were observed to indicated that RCNLOQB results significantly effected financial expenditure deviations within Her Majesty's Canadian Ships deployed in recent operations between 2000 and 2010. Hypothesis testing of RQ3 refined findings observed in RQ1 and indicated that statistically significant differences in financial expenditure deviations within Her Majesty's Canadian Ships deployed in recent operations between 2000 and 2010 occurred only in US-led military operation when Canada participated with multiple nations.

The sample of 171 participants satisfied the minimum number of 164 participants to achieve a statistical power of 95%, however, the data provided by the Royal Canadian Navy revealed that only approximately 30% of the sample had participated in an expeditionary military operation at sea, where a paired RCNLOQB score and financial deviation couplet could be analyzed. The low number of paired scores was observed in data skews and outliers. Although a correlation between RCNLOQB scores and Op APOLLO financial deviations was observed within a statistical significance of 0.01, this

outcome may be misleading because board scores prior to 2005 were all subjectively normalized to 70% when a candidate passed the RCNLOQB. Financial deviations were recorded as balanced at year-end for operations that occurred between 2000-2005. Government of Canada financial document retention policies preclude the independent verification of the source data as associated records have passed their retention period and have been subsequently destroyed. Despite some correlations that were expressed in descriptive statistics between RCNLOQB scores and financial deviation for specific missions, observed findings indicate that there is no statistically significant difference in mean RCNLOQB scores and mean financial deviations between expeditionary military operations SAIPH ALTAIR. The difference in the observed correlation of means for RCNLOQB and Op APOLLO may be attributable to ex post facto data manipulation by the retention authority and is deemed suspect for the purposes of future performance inferences related to the effect of RCNLOQB results on financial expenditure deviation in Her Majesty's Canadian Ships based on the nature of their military operation. This conclusion remains valid even after controlling for differences between military operations based on RCNLOQB scores when differences are analyzed across all types of expeditionary mission. The next chapter presents the final conclusions and recommendations based on the findings of this study.

Chapter 5

Conclusions and Recommendations

The purpose of this study was to compare the differences between financial expenditure deviations within Her Majesty's Canadian Ships (HMCS), based on Royal Canadian Navy Logistics Officer Qualification Board results attained between 2000 and 2010, categorized by the nature of Canada's military operations in Afghanistan (Operations APOLLO, ALTAIR, or SAIPH) between 2000 and 2010. The final reported financial position (surplus/deficit), of operational ships that have deployed in support of Canada's military operations in Afghanistan (Operations APOLLO, ALTAIR, or SAIPH) between 2000 and 2010, indicated the financial management deviation (dependent variable). The historical Royal Canadian Navy Logistics Officer Qualification Board results of Canadian Forces personnel (independent variables), comprised of 100% of Royal Canadian Navy Logistics Officers between the ranks of Lieutenant (Navy) and Commander were correlated with associated financial deviation to form paired scores. The differences between the paired scores, based on the nature of military deployments, and RCNLOQB results were compared to determine the degree to which RCNLOQB and the nature of military deployments effect financial deviations. The use of existing data provided by the RCN in this ex post facto study enabled a non-experimental, comparative, evaluation of differences in historical financial deviations of the three couplets of operations (e.g. ALTAIR to APOLLO, ALTAIR to SAIPH, and APOLLO to SAIPH). Although observed findings indicate differences in RCNLOQB scores and financial deviation pairs that are specific to different types of missions, the resulting

analysis does not indicate trends useful for predicting future financial deviations based on RCNLOQB results in specific operational categories.

Findings and Conclusions

Discussion of the Findings

Training measures for RCN Sea Logistics officers include consideration for financial management. Training outcomes are intended to produce reliable results that satisfy expected performance outcomes, primarily focused on supporting HMC ships, when deployed on military operations. In general, findings from a study of 171 RCNLOQB scores indicate that there is no correlation between RCNLOQB scores and financial deviations experienced in HMC ships that were deployed on expeditionary operations in support of missions in Afghanistan between 2000-2010. Additionally, in general there was no observed statistically significant difference between the effect of RCNLOQB scores on financial deviation. Statistically significant differences were observed RCNLOQB score and financial deviation during Operation APOLLO compared to Operation ALTAIR and Operation SAIPH. These differences inform conclusions regarding the potential effects of the nature of military operations on financial management based on RCNLOQB scores.

Findings associated with data related to Operation APOLLO indicate that Royal Canadian Navy Logistics Officer Qualification Board results significantly effect financial expenditure deviation within Her Majesty's Canadian Ships that deployed in US-led military operations with multiple nations. The R^2 for RCNLOQB scores and financial deviation recorded during Operation APOLLO was calculated at 0.469, indicating a lack of statistically significant determination. However, the Pearson Correlation was

statistically significant at the 0.01 level at -0.685 indicating a negative correlation of the paired scores in a two-tailed *t*-test. Assuming the unlikely probability that the actual results follow the skewed distribution as provided by the retention authority, Her Majesty's Canadian Ships participating in US-led military operations with multiple nations, decision-makers could expect to experience financial deviations. Based on the findings, these deviation would be increasingly underspent as RCNLOQB scores increased in value, with optimal budget management being observed between RCNLOQB scores of 70-71%.

Findings associated with data related to Operation ALTAIR indicate that Royal Canadian Navy Logistics Officer Qualification Board results do not significantly effect financial expenditure deviation within Her Majesty's Canadian Ships that deployed in Canada's military operations with the United States. The R^2 for RCNLOQB scores and financial deviation recorded during Operation ALTAIR was calculated at 0.058, indicating a lack of statistically significant determination. The Pearson Correlation was not statistically significant at -0.241 indicating a lack of correlation of the paired scores in a two-tailed *t*-test. The findings indicated that no predictions can be forecasted about Her Majesty's Canadian Ships participating in Canada's military operations with the United States regarding expected financial deviations. The obvious, uncorrelated negative trend line for Operation ALTAIR indicated financial allocations were increasingly underspent as RCNLOQB scores increased in value. The optimal budget deviation of +/-0.5% was not observed in the Operation ALTAIR results, which indicates more substantial financial deviations when HMC ships are deployed in Canada's military operations with the

United States compared to being deployed in US-led military operations with multiple nations.

Findings associated with data related to Operation SAIPH indicate that Royal Canadian Navy Logistics Officer Qualification Board results do not significantly effect financial expenditure deviation within Her Majesty's Canadian Ships that deployed in a multinational campaign. The R^2 for RCNLOQB scores and financial deviation recorded during Operation SAIPH was calculated at 0.064, indicating a lack of statistically significant determination. The Pearson Correlation was not statistically significant at 0.253 indicating a lack of correlation of the paired scores in a two-tailed *t*-test. The findings indicated that no predictions can be forecasted about Her Majesty's Canadian Ships deployed in a multinational campaign regarding expected financial deviations. The obvious, uncorrelated positive trend line for Operation SAIPH indicated financial allocations were less underspent as RCNLOQB scores increased in value. The optimal budget deviation of +/-0.5% was observed in the Operation SAIPH at RCNLOQB scores of 98-101%. As 100% is the upper-end of the RCNLOQB score range, the findings indicate that financial deviation would trend positively towards 0% as RCNLOQB scores increased, which indicates more substantial financial deviations when HMC ships are deployed in a multinational campaign compared to being deployed in US-led military operations with multiple nations.

Assumptions, Limitations, and Delimitations

Some of the limitations of the current study should be discussed to contextualize the findings observed in this research. The quantitative nature of this study does not include any consideration of the attitudes of individuals responsible for budget

management, nor does it discuss the relationships, discussions, interactions, or directions provided by higher authorities and decisions-makers that influenced operational requirements and directly impacted pressures placed on financial allocations. This study assumes that HMC ships' allocations are sufficient to satisfy requirements; deviations between planned and actual expenditures are therefore attributed to financial management decisions.

The lack of previous studies of this nature, limited the ability to compare observed findings with a documented baseline. The ex post facto nature of the study used recorded data, retained by the RCN, and was subject to changes associated with data recording, retention, and distribution mechanisms. RCNLOQB methodology and execution evolved over time and presented data that was based on different assumptions, and depending on the participants of the board, the scoring criteria, and the year in which the RCNLOQB was conducted. Despite sampling 171 RCNLOQB scores, which is sufficient to produce statistically significant results, the fact that not all qualified Sea Logistics Officers deploy on operations in HMC ships produced data pairs with small degrees of freedom for statistical analysis.

Assumptions

In Chapter 1, the dynamic nature of military operations was acknowledged as an inherent uncertainty that required management by operational commanders to balance resources with expected outcomes. For the purposes of this study, the role of operational commanders was isolated as a neutral factor that did not directly impact financial deviations in HMC ships. RCNLOQB results were assumed to be a primary factor in determining financial deviations in HMC ships. Despite the dynamic nature of military

operations with, Sea Logistics officers responsible for budget management have the ability to influence the final disposition of their financial position by seeking additional funding and allocation adjustments to offset unforecasted and originally unfunded operational requirements. It was assumed that RCNLOQB results would indicate financial management proficiency that would produce findings that would correlate financial management proficiency, through decreased financial deviations, based on demonstrated ability in the RCNLOQB. The findings presented in this study provide some substantive insight into the effect of RCNLOQB results on financial deviations in HMC ships based on the nature of military operations. However, the assumptions applied to this study do not indicate what other factors could also have effected financial deviations, or to what degree the independent variable effects financial deviations compared to other unidentified factors.

Limitations

The non-experimental nature of the ex post facto research design mitigates the ability to control the independent RCNLOQB results and nature of military operations. The design limitation of this study permitted the inclusion of data anomalies, such as the pre-2005 RCNLOQB score fixing at 70%, and the 2006 limitless RCNLOQB score, which returned some results over 100%. The ex post facto nature of the study produced findings that were differentiated by nature of military operation, however, the differences can not be inferentially attributed to the nature of those difference in a non-experimental ex post facto design because of the inability to conclusively eliminate and isolate other variables from the findings. The effects of the independent RCNLOQB result and nature of military operation variables were discussed in this study based on observed

differences. The nature of the study limits the potential to draw causality between the independent and dependent variables. The nature of military operations was found to substantively effect financial deviations in HMC ships; however, causality between variables, such as, RCNLOQB results and financial deviations for Her Majesty's Canadian Ships participating in US-led military operations with multiple nations where a correlation of paired scores was observed do not provide sufficient experimental evidence to support a cause and effect relationship between independent and dependent variables based on observed differences.

Delimitations

This study focused on the finance dimension of the Sea Logistics Officer occupation. Although a precise function, the comprehensive attitudes, skills, and abilities of a Sea Logistics Officer influence the individual's financial management decisions. Canadian officers were exclusively examined in this study. It is possible that Canada's relationships with other nations and the biases of individual Sea Logistics Officers towards other nations could also have effected the observed outcomes. This study did not include any consideration of operational or financial decisions made by other nations. The findings presented in this study are outlined from a Canada-centric perspective although they include operational relationships with other nations. The delimitations of this study isolates and neutralizes consideration of the potential effect of allied nations that participated in Operations APOLLO, ALTAIR, and SAIPH from the presented findings.

Thus, it is possible to conclude that financial deviations observed in Her Majesty's Canadian ships deployed on military operations could be effected by the

individual's ability to manage financial resources as well as a myriad of external factors related to individuals, Canada, foreign officers, or foreign nations. The management of financial resources is conducted in a dynamic environment and as such can be influenced by different factors to varying degrees based on the circumstances experienced at that time. The findings of this study did not present a correlation between RCNLOQB scores and financial deviation in *t*-tests, based on the nature of military operations, however, substantive differences observed in the findings present information that can be used to anticipate potential financial deviation trends based on the nature of military operations.

Significance of the Study

This study is significant because it highlights the broad range of financial deviation observed during military operations based on RCNLOQB scores. The mean RCNLOQB score between 2000 and 2010 was 77.5%, 7.5% higher than the passing threshold score of 70%. Reviewing the findings from results associated with operations in the RCN between 2000-2010 indicates that the nature of military operation has a substantive effect on financial deviations observed in HMC ships. Organizational leaders can use these findings to concentrate training activities towards producing Sea Logistics officers that are more proficient at managing financial resources and mindful of potential financial deviation trends based on the nature of military operations. Increased financial management ability will create tax savings by minimizing wastage and improving financial planning activities. The fact that differences between financial deviations were observed to converge very closely to the mean passing RCNLOQB score seems to suggest that average Sea Logistics Officers experienced smaller deviations compared to

their peers and perhaps either assumed less risk or assumed risk more reasonably resulting in smaller deviations.

The findings presented in this study can be further applied to finance officers in both the Canadian Army and Royal Canadian Air Force. The results presented in this study offer a baseline to inform military leaders in making decisions regarding factors that might effect financial training or potential financial deviation trends based on the nature of military operations as influenced by Canada's operational relationship with the US and other nations. Refinement of training objectives and performance outcomes would permit leaders to more accurately determine causal relationships between training plans and expect results. Understanding relationships between trained skills and performance outcomes can help predictively identify individuals who will be comparatively more effective in financial management through further study.

Recommendations

Recommendations for the Royal Canadian Navy

The Royal Canadian Navy has developed an assessment tool in the RCNLOQB that seems to consistently evaluate Sea Logistics Officers' abilities based on the observed distribution of their scores between 2000-2010. RCN training authorities may find this study useful in refining their training development plans and evaluation criteria to focus more specifically on job related tasks to better assess a candidates ability to successfully produce expected performance outcomes in a consistent manner. The criteria for improved RCNLOQB results should be reviewed to determine whether individuals with higher training results are conforming more closely to expected outcomes, or deviating based on the creativity of their solutions. The findings presented in this study indicated

that financial deviation decreased, as expected, when RCNLOQB scores increased. This substantive correlation was isolated to military operations when HMC ships deployed in a multinational campaign, as observed in historical data related to Operation SAIPH. The findings related to HMC ships that deployed in Canada's military operations with the United States (Operation ALTAIR) or deployed in US-led military operations with multiple nations (Operation APOLLO) indicated a contrary effect, in that, financial deviation increased as RCNLOQB scores increased. This latter findings related to Operations ALTAIR and APOLLO were counter-intuitive to the nature and purpose of the RCNLOQB, and indicates a disconnect between the board's purpose as a performance indicator in the context of this study.

The findings in this study seem to indicate that Sea Logistics Officers tend to experience a relatively similar and consistent degree of financial deviation, regardless of the nature of financial deviation when their RCNLOQB scores are closely related to the passing threshold of 70%. This finding could be a result of deliberate data manipulation by the retention authority that occurred pre-2005, however, assuming that the results are accurate as observed, officers who met the minimum threshold may be more inclined to adhere to trained financial management behaviors and may therefore experience reduced degrees of financial deviation. The RCN Sea Logistics Training authority should consider conducting deliberate, experimental research to determine causal relationships of trained skills with performance outcome to identify the correlation between specific training objectives to better inform potential areas for training and evaluation adjustment.

Recommendations for Future Research

Quantitative research and analysis remains a driving factor for most significant financial decisions within the Canadian Armed Forces because it provides a tangible and defendable argument for the expenditure and management of public funds. Future research should use the RCNLOQB result baseline presented in this study to conduct further analysis on the effect and correlation of trained skills against performance outcomes. Additional experimental research can build upon the findings of this study by comparing differences between observed data with known means to assess consistency or deviation from previous results.

The role and influence of qualitative attitudes and factors should be included in the analysis of financial management because they may have a significant effect on the business decisions of officers responsible for financial resources. The dynamic nature of military operations should be included and examined in future studies as an experimental factor that is assumed to directly effect performance outcomes in a statistically significant yet qualitative manner.

Although this study was able to investigate whether Royal Canadian Navy Logistics Officer Qualification Board results significantly effect financial expenditure deviation within Her Majesty's Canadian Ships based on the nature of military operations. The difference found between RCNLOQB result effect on financial deviation in HMC ships that deployed in US-led military operations with multiple nations compared to other types of missions, it is important to replicate the current study in a variety of organizational settings, both internal and external to the RCN, and to continue

to quantify the relationship and effect of training objectives with performance outcomes based on the nature of military operations.

Summary

The purpose of this study was to compare the differences between financial expenditure deviations within Her Majesty's Canadian Ships (HMCS), based on Royal Canadian Navy Logistics Officer Qualification Board results attained between 2000 and 2010, categorized by the nature of Canada's military operations in Afghanistan (Operations APOLLO, ALTAIR, or SAIPH) between 2000 and 2010. The current study demonstrates that there is statistically no difference in mean RCNLOQB score and financial deviation. Based on observed differences, Royal Canadian Navy Logistics Officer Qualification Board results were found to have a statistically significantly effect on financial expenditure deviation within Her Majesty's Canadian Ships that deployed in US-led military operations with multiple nations compared to HMC ships that deployed in with only the US or in multinational campaigns. The influences of other individual attributes related to the relevant Sea Logistics Officer and their relationships with external entities were not included in this study but are deemed to contribute to performance outcomes to an unknown degree. Despite some statistically significant findings presented in this study, the results should be considered a false positive until replicated through another independent study based on the pre-2005 RCNLOQB score data normalization. The ex post facto nature of this study limits the ability to make causal inferences on future outcomes from the findings. The effects of qualitative subjective factors were not included in this study and require further research to determine their degree of influence on financial management performance outcomes.

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Appendix A

Permission to Use Premises, Name, and/or Subjects of Facility, Organization, University Institution, or Association

University of Phoenix®

PREMISES, RECRUITMENT AND NAME (PRN) USE PERMISSION

Department of National Defence

Name of Facility, Organization, University, Institution, or Association

Please complete the following by check marking any permissions listed here that you approve, and please provide your signature, title, date, and organizational information below. If you have any questions or concerns about this research study, please contact the University of Phoenix Institutional Review Board via email at IRB@phoenix.edu.

☒ I hereby authorize **Commander Nord K. Mensah**, a student of University of Phoenix, to use the premises (facility identified below) to conduct a study entitled **Quantitative Expenditure Deviation Comparison based on Canadian Navy Logistics Officer Qualification Results and Type of Military Operation.**

☒ I hereby authorize **Commander Nord K. Mensah**, a student of University of Phoenix, to recruit subjects for participation in a conduct a study entitled **Quantitative Expenditure Deviation Comparison based on Canadian Navy Logistics Officer Qualification Results and Type of Military Operation.**

☒ I hereby authorize **Commander Nord K. Mensah**, a student of University of Phoenix, to use the name of the facility, organization, university, institution, or association identified above when publishing results from the study entitled **Quantitative Expenditure Deviation Comparison based on Canadian Navy Logistics Officer Qualification Results and Type of Military Operation.**

Signature

04 Sept 2014
Date

E.M. Steele

Rear-Admiral
Department of National Defence
National Defence Headquarters
101 Colonel By Drive
Ottawa, ON K1A 0K2
Canada

Appendix B

Letter of Collaboration Among Institutions

UNIVERSITY OF PHOENIX

LETTER OF COLLABORATION AMONG INSTITUTIONS

Date: 04/09/2014

To: Office of the Provost/Institutional Review Board
University of Phoenix

This letter acknowledges that

Department of National Defence is collaborating with
(Name of the agency)

Mr. **Commander Nord K. Mensah**
(Name of the student)

enrolled in the **Doctor of Business Administration** program at the University of Phoenix in conducting the

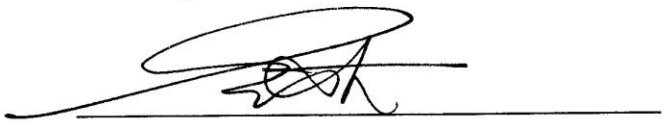
proposed research. We understand the purpose of this research

is **Quantitative Expenditure Deviation Comparison based on Canadian Navy Logistics Officer Qualification Results and Type of Military Operation**

and will be conducted under the supervision of Dr. **Jay Klagge.**
(Faculty Name)

This project will be an integral part of our institution/agency and will be conducted as a collaborative effort and will be part of our curriculum/research/data/service delivery model.

Sincerely,



E.M. Steele

Rear-Admiral
Department of National Defence

Appendix C

Data Access and Use Permission

University of Phoenix®

DATA ACCESS AND USE PERMISSION

Department of National Defence

Name of Facility, Organization, University, Institution, or Association

Please check mark any of the following statements that you approve regarding the study and data described below:

☒ I hereby authorize **Commander Nord K. Mensah**, a student of University of Phoenix who is conducting a research study titled or described as follows: **Quantitative Expenditure Deviation Comparison based on Canadian Navy Logistics Officer Qualification Results and Type of Military Operation,** access to, and use of, the non-identifiable archival data described as follows: **historical data regarding Her Majesty's Canadian Ships' operational, fiscal year-end financial positions has been sought from the Royal Canadian Navy (RCN), including the RCN Logistics Officer Qualification Board results for the relevant RCN Logistics Officers,** for use in the aforementioned research study. In granting this permission, I understand the following (please check mark each of the following as applicable):

☒ The data will be maintained in a secure and confidential manner.

☒ The data may be used in the publication of results from this study.

☒ This research study must have IRB approval at the University of Phoenix before access to the data identified here is provided to **Commander Nord K. Mensah.**

☒ Access to, and use of, this data will not be transferred to any other person without my/our express written consent.

☒ The source of the data may be identified in the publication of the results of this study.

☒ Relevant information associated with this data will be available to the dissertation chair, dissertation committee, school as may be needed for educational purposes.

E.M. Steele
Rear-Admiral

04 Sept 2014
Date

Department of National Defence
National Defence Headquarters
101 Colonel By Drive
Ottawa, ON K1A 0K2
Canada

Researcher Signature/Acknowledgement

04 Sept 2014
Date

Current version 032012

Appendix D

Confidentiality Statement

Quantitative Expenditure Deviation Comparison based on Canadian Navy Logistics Officer Qualification Results and Type of Military Operation

Nord K. Mensah

CONFIDENTIALITY STATEMENT

As a researcher working on the above research study at the University of Phoenix, I understand that I must maintain the confidentiality of all information concerning all research participants as required by law. Only the University of Phoenix Institutional Review Board may have access to this information. "Confidential Information" of participants includes but is not limited to: names, characteristics, or other identifying information, questionnaire scores, ratings, incidental comments, other information accrued either directly or indirectly through contact with any participant, and/or any other information that by its nature would be considered confidential. In order to maintain the confidentiality of the information, I hereby agree to refrain from discussing or disclosing any Confidential Information regarding research participants, to any individual who is not part of the above research study or in need of the information for the expressed purposes on the research program. This includes having a conversation regarding the research project or its participants in a place where such a discussion might be overheard; or discussing any Confidential Information in a way that would allow an unauthorized person to associate (either correctly or incorrectly) an identity with such information. I further agree to store research records whether paper, electronic or otherwise in a secure locked location under my direct control or with appropriate safe guards. I hereby further agree that if I have to use the services of a third party to assist in the research study, who will potentially have access to any Confidential Information of participants, that I will enter into an agreement with said third party prior to using any of the services, which shall provide at a minimum the confidential obligations set forth herein. I agree that I will immediately report any known or suspected breach of this confidentiality statement regarding the above research project to the University of Phoenix, Institutional Review Board.

/s/ Nord K. Mensah	Nord K. Mensah	09/04/2014
Signature of Researcher	Printed Name	Date
/s/ Jay Klagge	Jay Klagge	09/04/2014
Signature of Witness	Printed Name	Date

AUTHOR BIOGRAPHY

Commander (Cdr) Nord Kofi Mensah joined the Royal Canadian Navy as a Reserve Maritime Surface/Sub-surface (MARS) Officer in 1998. He transferred to the Regular Force as a Logistics Officer in 2000, after successfully completing his MARS phases two and three training. A West coast sailor, he sailed with Canada's Pacific fleet in Her Majesty's Canadian Ships (HMCS) OTTAWA and VANCOUVER, as Assistant Logistics Officer and Logistics Officer respectively. Cdr Mensah deployed to the Persian Gulf with Operation APOLLO Rotation 1. His operational support experience includes Fleet Logistics Operations Officer for Canadian Fleet Pacific, Senior Fleet Logistics Officer for Canadian Fleet Atlantic, Sea Training Logistics Officer in both Pacific and Atlantic fleets, Canadian Special Operation Forces Command Joint Logistics Operations Officer, and Special Operations Forward Logistics Officer with Canada's premiere special operation forces unit, JTF-2. His recent operational experience was as the Officer Commanding the Contract Management Cell in the Mission Closure Unit, Operation ATHENA Roto 11, Mission Transition Task Force, in 2011.

Cdr Mensah holds an undergraduate degree in Physical Education from the University of Alberta, a Master's in Business Administration from the University of Phoenix. He is an enthusiastic motorcyclist, snowboarder and scuba diver. He finds time to participate in these hobbies when not enjoying time with his wife and five children. Cdr Mensah is presently the designated Command Officer of Base Logistics in Canadian Forces Base Esquimalt on Vancouver Island, British Columbia.

Honours and Awards: Cdr Mensah was an Aide-de-Camp to the Her Honour Iona Campanolo, former Lieutenant-Governor of British Columbia from 2003-2007. Cdr

Mensah has been decorated with the General Campaign Star – Afghanistan, the South West Asia Service Medal (w/Afghanistan bar), the Canadian Forces Decoration, and the Chief of the Defence Staff Commendation for outstanding leadership during his 2011 command in Afghanistan.