National Defence Défense nationale

Canadian Forces College

Collège des Forces Canadiennes

# ANALYTICS IN DEFENCE: EMERGING DIGITAL TRANSFORMATION AND EMPOWERING ALL LEADERS

**Major Selena Aral**

## JCSP 45

## Master of Defence Studies

**Disclaimer**

Opinions expressed remain those of the author and do not represent Department of National Defence or Canadian Forces policy. This paper may not be used without written permission.



## PCEMI 45

## Maîtrise en études de la défense

**Avertissement**

Les opinons exprimées n'engagent que leurs auteurs et ne reflètent aucunement des politiques du Ministère de la Défense nationale ou des Forces canadiennes. Ce papier ne peut être reproduit sans autorisation écrite.



Canada

CANADIAN FORCES COLLEGE / COLLÈGE DES FORCES CANADIENNES

JCSP 45 – PCEMI 45
2018 – 2019

MASTER OF DEFENCE STUDIES / MAÎTRISE EN ÉTUDES DE LA DÉFENSE

# ANALYTICS IN DEFENCE: EMERGING DIGITAL TRANSFORMATION AND EMPOWERING ALL LEADERS

By: Lieutenant-Commander Selena Aral



Word Count : 14279

Nombres de mots: 14279

# TABLE OF CONTENTS

List of Figures 3

Abstract 4

Chapter

1. Introduction 5
2. Literature Review 11
3. Benefits of Analytics Through all Core Functions 14
4. Sustainment Deeper Dive 26
5. Target Architecture Concept and Analytics Use Case Resolution 48
6. Issues with the Use of Analytics in Organizations 54
7. Change Management 58
8. Conclusion and Recommendations 64

Bibliography 67

## LIST OF FIGURES

Figure 4.1 - Regular Force Enrolments for FY 17/18 29

Figure 4.2 – Annex A OAG Report 31

Figure 4.3 – CMIS Extraction 33

Figure 4.4 – Enrollment by Trade FY 17/18 34

Figure 4.5 – Attrition Rate for Logistics Trade 36

Figure 4.6 – Wait times 37

Figure 5.1 – Current Target Architecture vs Potential Architecture 50

Figure 5.2 – Methodology 52

Figure 7.1 – Kotter's 8 Steps 60

**ABSTRACT**

Over the last five years the Canadian Armed Forces (CAF) has increasingly been drawn to the idea of using analytics to enable and assist in defence operations and decision-making. In an emerging environment of digital transformation, the CAF has been attempting to improve its business governance and accountability in order to support Government of Canada (GAC) initiatives and pressures for a Strong, Secure and Engage (SSE) defence, national security and sovereignty. The Canadian government has announced their desire to create a Defence Analytics Institute in order to create more transparency throughout the organization and to better inform the defence decision-making process. The government has announced that they will provide an annual increase in spending towards defence analytics by $2.3 million per year. In an effort to explore the possibilities of analytics in defence with all the emerging technologies, this research paper strives to uncover the true benefits of implementing a robust analytics platform. This robust analytics platform would have the capability of integrating both structured and unstructured data sources that could best provide quality information for decision making purposes across all operational functions: Command, Act, Sense, Shield and Sustain. This paper also provides an in depth discussion on the ability for analytics to provide the necessary tools, software and platform to support the new and modern employment initiative, “The Journey.” The use of a powerful analytic platform aspires to provide the CAF with the ability to integrate large data sets and manipulate data from multiple information technology platforms. With the emerging domains of Cyber and Space, the CAF must become innovative and capable of providing defence and security to Canada while staying ahead of rapidly changing technological environments.

# CHAPTER 1 - INTRODUCTION

Over the last five years the Canadian Armed Forces (CAF) has increasingly been drawn to the idea of using analytics to enable and assist in defence operations and decision-making. In an emerging environment of digital transformation, the CAF has been attempting to improve its business governance and accountability in order to support Government of Canada (GAC) initiatives and pressures for a Strong, Secure and Engage (SSE) defence, national security and sovereignty. Analytics and the use of analytical platforms aspires to provide the CAF with the ability to integrate large data sets and manipulate data to formulate key information that can enhance decision-making at all levels of leadership.

In 2014, the CAF moved towards establishing a business analytics capability on its DWAN network. However, in 2015 "the government proposed to raise the department's annual budget escalator from 2.5 to 3 percent, meaning a gradual increase to $2.3 billion by 2026-27."[1] The most notable promises given by the budget that year was the in increase in defence spending by $2.5 million per year starting in 2016/2017, "to support the Defence Analytics Institute, a key pillar of the new defence procurement strategy that would increase the government's analytical capacity."[2] In response to the governments desire to create a Defense Analytics Institute a new department was formed within the CAF, Defence Program Analytics. Currently, the CAF's vision of Defence Program Analytics is to provide "an affordable and scalable capability that establishes unity of effort and agility across people,

[1] Vanguard Staff, "DND Increase Pending, but Budget 2015 Delivers Industry Support," *Vanguard* (Apr 28, 2015). https://vanguardcanada.com/2015/04/28/dnd-increase-pending-but-budget-2015-delivers-industry-support/.
[2] Vanguard Staff, "DND Increase Pending, but Budget 2015 Delivers Industry Support," *Vanguard* (Apr 28, 2015). https://vanguardcanada.com/2015/04/28/dnd-increase-pending-but-budget-2015-delivers-industry-support/.

processes and tools."[3] Since DPA's inception they have been working on developing analytics through five key value cases:

a. The SSE implementation which provides clear direction on Canadian priorities over a 20-year horizon;
b. Defence Results Framework (DRF) which links Government of Canada's defence spending directly with defence capabilities;
c. Integrated Resource Management Committee which moves towards optimizing resources to support capability growth and sustainment;
d. Supply Chain Analysis and the optimization of material management; and
e. Force Posture and Readiness linking capability with the ability for Canada to respond to domestic and international operations.[4]

Through the efforts of ADM (IM) and SAP, the establishment of a Business Warehouse (BW) platform and a Business Objects (BOBJ) suite was incorporated into the baseline enclave network. This gave CAF the capability of analyzing information from already existing data bases like Defense Resources Management Information System (DRMIS) and the Fleet Management System (FMS) in new and more informative ways. This new capability continues to evolve in providing leadership and management at all levels with key decision-making information in order to better evolve the business processes within each function and domain. Eventually, the desire will be that all leaders and managers will be able

[3] Extracted from the Defence Program Analytics site on the intranet (DWAN): https://collaboration-vcds.forces.mil.ca/sites/defenceanalytics/Defence%20Program%20Analytics%20Value%20Cases/Forms/AllItems.aspx
[4] Extracted from the Defence Program Analytics site on the intranet (DWAN): https://collaboration-vcds.forces.mil.ca/sites/defenceanalytics/Defence%20Program%20Analytics%20Value%20Cases/Forms/AllItems.aspx

to create and design self-service analytics, to enhance their planning and decision-making.[5] These self-service analytics will in turn increase the effectiveness and efficiency throughout all elements, units, organizations and even operational task forces.

The CDS and Minister of National Defence along with the cabinet have stressed that government spending on defence must be more transparent.[6] The CAF must move towards aligning dollars and cents to capabilities and ultimately generating an accurate picture of sustainability of all missions at home and abroad. For example, with the emergence of Business Intelligence (BI), the CAF would know exactly how much it will cost to say yes to foreign missions in Afghanistan, Iraq and other areas while also sustaining other United Nations (UN) or North American Treaty Organization (NATO) efforts around the world. In the realm of analytics however, the answer to key questions will go beyond cost. The CAF could have the ability to know whether it has enough troops and equipment to conduct all lines of tasks and have the predictive capability in terms of knowing when certain decisions render the mission unsustainable.

Currently, CAF is not able to answer key questions with tangible analytics that can help provide the government with sound information for effective defence and security decision-making. Understanding the business of defence will not only require the use of highly measurable metrics and key performance indicators, it will also require the robust analysis of extremely large data sets. One could argue that essentially without the use of

[5] Desire is derived from the information on the Defence Program Analytics Intranet Site.
[6] National Defence, "National Defence Launches Investment Plan to Improve Openness, Accountability and Results in Defence Spending," *Government of Canada* (May 30, 2018). https://www.canada.ca/en/department-national-defence/news/2018/05/national-defence-launches-investment-plan-to-improve-openness-accountability-and-results-in-defence-spending.html.

analytics, the CAF is operating with a state of blindness. For example, currently it takes roughly 14 to 15 hours to extract data from DRMIS a report that would indicate dormant stock within the organization. This dormant stock could be extremely obsolete, yet thousands of line items of dormant stock exist in many organizations throughout the CAF. This stock is being warehoused and is unnecessarily using major overhead costs. To extract a dormant stock report, it involves lengthy crosschecking and line by line spreadsheet analysis to achieve one calculation, the percentage of dormant stock. It would take even longer to figure out the actual line items and locations of this dormant stock. While Enterprise Planning (ERP) systems like DRMIS "do a good job of streamlining business processes, the ever-increasing volume of data they kick out is overwhelming."[7] With an analytic platform, this type of report can be generated in a matter of minutes. Ultimately the speed at which this report is generated frees up significant work hours for those responsible of this stock and can allow for more time to analyze the information that can inspire critical thinking and key decision-making capabilities. This is just one example of how analytics and business intelligence can enhance the CAF's ability to operate. The actual problem that analytics can resolve for the CAF is the impossible task of aggregating the data that exists in multiple platforms that are both structured and unstructured data sources. Information that exist in one platform may have valuable information that would transcend the information in another platform. Currently the analytics evolution in CAF has been to concentrate on the logistical functions since much of logistical information already exists within two-dimensional database platforms. Logistical functions

[7] Mitchell Stevenson et al., "How Analytics Improves Decision Making at the Department of Defense Finding New Ways to Add Value and Insights to Big Data," *Sas* (2014). https://www.sas.com/content/dam/SAS/en_us/doc/conclusionpaper1/analytics-improve-decision-making-at-dod-107024.pdf.

here meaning finance, supply chain management, movements, maintenance, human resources and food services.

The digital transformation journey should develop further to incorporate and develop capabilities through all of its core functions (Command, Act, Sense, Shield and Sustain). Moving beyond logistics would require a platform that can not only conduct analytics on rudimentary two-dimensional databases, but it will also be required to process and make sense of disparate and unstructured non-quarriable data. “Defence has to face the challenge and invest in Big Data technologies and associated infrastructures that will be adapted and oriented to the characteristics of the defence priorities.”[8] Moving towards analytics within all core functions through the use of a powerful platform that can read and manipulate both structured and unstructured data, would ultimately create an effective defence organization that could attain all goals and aspirations set out in the CAF’s current defence policy, SSE.

Given that analytics within CAF is in its inception stage, this directed research project will first provide a literature review on the resources available on the subject. Then it will discuss the possibilities that analytics could bring to defence through all five core operational functions: Command, Act, Sense, Shield and Sustain. It will then dive deeper into the potential resolution spaces for two problem sets under the Sustain function. These problem sets are the Journey and Sustain Effects in International Missions. This research project will then discuss target architecture concepts that could support an integrated defence analytics platform. There will also be a brief discussion on the negative aspects of the use of analytics

[8] Ignacio Montiel-Sanchez, "Big Data Analytics for Defence," https://www.eda.europa.eu/webzine/issue14/cover-story/big-data-analytics-for-defence (accessed 03 Mar, 2019).

in an organization which will lead into another key aspect of digital transformation, which is change management. In the analytical world, problem sets are normally referred to as “use cases”. For ease of discussion a problem set is further defined as the key issues that exists within a core function or subset of a core function. The Defence Program Analytics renamed the term “use case” to “value case” when the resolution of the use case brings value to the CAF organization. Going forward the expression “value case” will be used when referring to a problem set that would provide value.

## CHAPTER 2 - LITERATURE REVIEW

Although Analytics in Defence is a fairly new concept, the idea of using quantitative information for decision-making has been around for decades. In 1911, a mechanical engineer by the name of Frederick Taylor published a book entitled *The Principles of Scientific Management*. In this book he determined methods of measuring the time management and productivity of workers.[9] Over the years the use of computers as mechanisms for decision support became more apparent as computer processing power became stronger. [10] Analytics has followed a typical adoption curve with early adopters pioneering the technology to organizations and businesses just newly coming on board the digital transformation environment.[11] There is lots of information on the topic from universities to business involved with digital transformation technologies. The majority of the digital transformation literature pertains to corporations and profit organizations. Although defence business processes can mirror the corporate world there are also fundamental differences. For example, if we compare the differences in the Supply Chain Management System in the CAF versus the supply systems in the corporate world, one major difference is that most retail organizations have a one-way supply management system. In other words, inventory is procured and brought in, then it is sold on the back end for profit. Whereas, inventory coming into the CAF is a two-way system. It is brought in and stored until it is no longer required for use, then it is deliberately discarded, sold or destroyed when the inventory is no longer required. Although

[9] Frederick Wilson Taylor, *The Principles of Scientific Managment*Harper and Brothers, 1911).
[10] Keith D. Foote, "A Brief History of Analytics," *Dataveristy*, no. Data Topics (September 25, 2018). https://www.dataversity.net/brief-history-analytics/.
[11] Jean Paul Isson and Jesse S. Harriott, *People Analytics in the Era of Big Data* (New Jersey and Canada: John Wiley & Sons, Inc., 2016).p. 35

there are differences, there is much to be gained by looking at how other corporations conduct their business.

Much of the information provided in this research paper is given based on the author's job experiences as well as live experiences working with all the mentioned logistical database systems, including the career management information systems. Furthermore, the author was involved with the implementation of analytics in the East Coast Base Logistics organization as well as the development of the analytic campaign plan for CANSOFCOM. During the author's time as the J4 Systems for CANSOFCOM, she worked directly with SAP and Accenture in Ottawa to uncover methodologies and target architecture knowledge as well as extensive software knowledge. Knowledge about the recruiting and onboarding software was provided by SAP offices located in Toronto. When it comes to literature regarding the support to Human Resource management, an excellent resource is the book entitle *People Analytics in the Era of Big Data*. This book goes into extensive detail of the use of big data platforms to uncover key information for Human Resource Management. Much of the research brought forward in this book comes from recent documents up to the publishing year to very historical documents and books from the early 19th century. This book is a great point of reference to assist with not only analytics within human resource management, but there is also a good discussion on organizational change management.

From all the resources available there was a gap in the references for three concepts mentioned within this research paper. The first concept is mission analytics. This type of analytical platform is still in the development stage. There are companies that are offering their software, however there is no research at this time that speaks to the software's effectiveness in warfighting operations. Currently the US is trailing a common operating

platform that offers a full and holistic mission analytical platform that is capable of assisting with warfighting decision-making processes. The second information gap was in the realm of career management for defence organizations. Much of the literature regarding career management pertained to corporations. Although there were discussions about offering employees advancement opportunities, the dynamics of a military work environment were quite different. In most cases employees within a corporation may be offered promotions and advancements but it may be less frequent that military members who are required to change positions every 2 to 3 years. There is however one research document that compares the employment path of military members across NATO organizations. However, within that document there was no discussion on career management models. The third information gap was in the realm of Sustainment Effect during international missions. When going into international missions, many local sustainment contracts are created. Various local fuel companies, rental car companies and constructions supply companies among others are locally contracted to provide sustainment services for the forces located in the AOR. Currently, there is no research or literature information that defines the impact of these sustainment functions on the local economy as well as local enemy force, criminal organizations and black market. Although this paper touches on the third topic, it would require extensive research to uncover the true parameters behind sustainment effects.

# CHAPTER 3 - BENEFITS OF ANALYTICS THROUGH ALL CORE OPERATIONAL FUNCTIONS

Currently the leading solution technology for the CAF analytics has been assisted by industry. Both SAP and IBM as well as other smaller technical boutique companies such as Accenture have been fundamental in orienting the CAF towards effective digital transformation. There are many other companies that provide big data analytics platforms, among them are: Microsoft, Cloudera, SAS, and Oracle.[12] The DRMIS system that was custom designed for CAF and built by SAP, was originally created to provide an upgrade to the older Financial Management Accounting System (FMAS) and the Material Information Management System (MIMS). DRMIS allowed for the ability to combine both transactional databases, providing an integrated picture of both material management and financial management information systems. From 2009 onward all elements slowly migrated onto the new platform. It took time for proper familiarization and user training to fully understand the capability of this new system. Although not fully discovered until a few years later, the DRMIS system had the Business Intelligence Suite available as part of the platform.[13] At this point in time DPA is focused on developing analytics in mainly the Sustain areas of CAF. However, it will be imperative to move towards a platform that allows the CAF to conduct analytics on data sources beyond just two-dimensional structured databases. The new capability will need to provide a broad-spectrum vision of analytics that enhances not only the logistical and support structures and processes, but also enhances command, operations and

[12] Doug Henschen, "16 Top Big Data Analytics Platforms," https://www.informationweek.com/big-data/big-data-analytics/16-top-big-data-analyticsplatforms/d/d-id/1113609 (accessed Dec 15, 2018).
[13] This fact was revealed during the discussions with SAP as part of the planning process for CANSOFCOM's analytic platform. The Author was part of the team that formulated CANSOFCOM's analytics campaign plan.

intelligence. This will ultimately evolve the organization to higher data analytics maturity by putting in place descriptive analytics to describe what has happened, where we are at now, and insights into why.[14] Descriptive analytics include dashboards, data mining, trend analysis, linear analysis, and BI reporting. The analytical evolution can also lead to predictive analytics such as forecasting, simulation, modeling, non-linear regression, sensitivity, cost-benefit and what-if analysis. [15] Predictive analytics provide decision support insights into the future – where things are heading. Finally, the evolved analytical capability could further mature to prescriptive analytics through the use of machine learning and artificial intelligence that would provide optimization, experimentation, and game theory based decision support [16] – providing decision quality insights into how to change or create alternative futures. Evolved analytics in Defence through all core functions could enhance the CAF's ability to operate with greater precision, agility, efficiency and effectiveness. The next subsections will discuss possible efficiencies that could be seen in each core function. For ease and flow of the discussion the benefits of analytics through all the core functions will be discussed in the following order: Sustain, Shield, Sense, Act, and Command.

**Sustain**

In order to digitally transform an extremely complex organization such as the CAF, it is important to start with core functions of the organization that can easily be transformed. The

[14] Blake Morgan, "Descriptive Analytics, Prescriptive Analytics and Predictive Analytics for Customer Experience," https://www.forbes.com/sites/blakemorgan/2019/02/21/descriptive-analytics-prescriptive-analytics-and-predictive-analytics-for-customer-experience/#4dcf83b869e0 (accessed Apr 14, 2019).
[15] Blake Morgan, "Descriptive Analytics, Prescriptive Analytics and Predictive Analytics for Customer Experience," https://www.forbes.com/sites/blakemorgan/2019/02/21/descriptive-analytics-prescriptive-analytics-and-predictive-analytics-for-customer-experience/#4dcf83b869e0 (accessed Apr 14, 2019).
[16] Blake Morgan, "Descriptive Analytics, Prescriptive Analytics and Predictive Analytics for Customer Experience," https://www.forbes.com/sites/blakemorgan/2019/02/21/descriptive-analytics-prescriptive-analytics-and-predictive-analytics-for-customer-experience/#4dcf83b869e0 (accessed Apr 14, 2019).

sustain function incorporates all the support mechanisms and business processes that are required to manage, develop, project and sustain resources. Logistical processes are essentially the backbone that ensures success and efficiency that is absorbed by all areas and branches of the CAF. “The success or failure of logistic support to battles changes the outcome of those battles, and sometimes the wars within which they are being fought.”[17] Given the business-like nature of the sustain function, much of the data required to analyze logistical process are already contained in two-dimensional structured databases. Although DRMIS allowed for the integration of both the material management and financial management systems, many of the other logistical databases exist on other platforms such as Guardian, Fleet Management System, and even localized spreadsheets made by various end-users. The use of an analytics platform that can integrate information from one database to another and provide data manipulation capabilities, would allow for a more three-dimensional view of the information and can add value and sense to the plethora the information that exists. “Data should empower, not overwhelm, decision-makers.”[18] To demonstrate one of the small successes that was experienced by the adoption of analytics, occurred in the Royal Canadian Navy (RCN) in the Base Logistics organization in Halifax, Nova Scotia. During that time the Procurement Cell at Base Logistics (BLOG) had roughly twenty buyers. It was known that these buyers were essentially over worked with procurement tasks coming from the East Coast Fleet and surrounding lodger units. Once the Business Intelligence platform came on line, BLOG was able to have a deeper look at the work flow. The analysis uncovered

[17] Jeremy Smith, "History of Defence Logistics: Understanding the Value Today," https://www.koganpage.com/article/history-of-defence-logistics-understanding-its-value-today (accessed Mar 14, 2019).
[18] Nathan Houser and Ted Johnson, "Data-Driven Deployments how Analytics can Transform Military Positioning," *Deloitte Development LLC* (2017). p. 3.

that the majority of the buys going through the Procurement Cell were for procurements under $1,000. This piece of information was extremely valuable. Most of the fleet, except the Submarines and the Minesweepers, have a logistics officer on board who is capable and trained to oversee local procurements up to $5,000 according to the financial delegations of authority for the coast. It quickly did not make any sense that the Procurement Cell who is capable of managing more complex and higher risk procurements, be inundated with purchases that are under $1,000. This led to a change in policy on the coast indicating to all units and ships who are capable of doing their own low dollar procurements to take the responsibility and execute procurements under $1,000. Eventually this policy was then increased to procurements under $5,000, which then freed up the procurement cell to concentrate on more complex, higher value and higher risk contracts.[19] Analytics for the sustain function allows for transparency and the removal of business process blindness. Bottlenecks that were being experience can then be easily rectified by uncovering the root problem. According the July 2013 McKinsey Global Institute report, analytical platforms that are capable of processing big data will provide the US government with the transparency that could potentially reduce "federal procurement costs by up to $140 billion annually by 2020."[20] When it comes to sustainment there are so many aspects that could benefit from a robust analytics platform. This paper will take a closer look at two Sustainment Value Cases that could see a great benefit from the application of analytics in a later section.

[19] The Author of this paper was the Executive Officer of Base Logistics during these discoveries and policy changes.

[20] Susan Lund et al., "Game Changers: Five Opportunities for US Growth and Renewal," *McKinsey Global Institute* (2013), 83. https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Americas/US%20game%20changers/MGI_Game_changers_US_growth_and_renewal_Full_report.ashx.

**Shield**

The operational function shield is about the protection of forces, assets and capabilities. The protection of forces is vital to the success of any mission. Today's battlefield is increasingly complex with the addition of both Cyber and Space domains to the traditional Air, Land and Sea domains. Historically in regular conventional warfare, leaders had to make deliberate decisions with regards to forces and asset laydown locations to ensure the best possible protection overall. There are many possibilities of threats that could occur to both forces and assets. These threats could come in the form of enemy forces as well as the environment and weather. To mitigate these threats, the military staff and leaders conduct threat assessments and risk analysis in the planning process to attempt to uncover all possible threats and their probability for occurrence. The outcomes could be numerous and could potentially be unpredictable. Analytical platforms that can provide mission analytics could uncover all the various outcomes and probabilities with greater accuracy. Rather than determining threat possibilities based on a subjective gut feeling or hunch, analytics could provide a more objective and accurate assessment of all possible threats and outcomes. "Analytics has proven to be an invaluable tool for those seeking to identify patterns, understand phenomena, or solve problems."[21] Having a true understanding of the environment with a full analysis of all potential threats could prove to be a crucial way to protect forces and assets deployed on missions with emerging domains that are still fairly new and unknown.

**Sense**

[21] Houser and Johnson, "Data-Driven Deployments how Analytics can Transform Military Positioning," *Deloitte Development LLC* (2017).

The sense operational function pertains to deliberate information gathering, analysis of information and the transformation of information into knowledge for command. “The Sense function incorporates all capabilities that collect and process data.”[22] However, the data that requires analysis and collection within the intelligence field often comes from unstructured non-quarriable data sources. Furthermore, data coming from live sources such as Twitter, Facebook and News feeds could be astronomical in size, which is why this type of unstructured data has been given the term “Big Data.”[23] The increase in the existence of big data comes from the increasingly social society all using smart phones that can generate pattern of life information, geospatial tagging and live chat feeds.[24] The largest problem set in the intelligence field is to have the capability to sift through all that information to find small pieces of information that would ultimately effect defence planning and execution. Key pieces of information that could prevent terrorist attacks. Key pieces of information that could lead to high value targets. No matter how many intelligence operators there are, it would be impossible given all the data to truly see all the critical pieces of information at all times. Furthermore, there is the additional complexity of having the capability to share these key pieces of information with other allied intelligence agencies without compromising the operational security of the information itself. “Big data yields not simply a quantitative increase in information, but a qualitative change in how we create new knowledge and understand the world.”[25] In a documentary film entitled “The Gatekeepers,” it discusses the extensive information gathering tactics of the Israeli Security Agency. The entire country is

[22] (Department of National Defence 2010) p. 1-6.
[23] Montiel-Sanchez, "Big Data Analytics for Defence," https://www.eda.europa.eu/webzine/issue14/cover-story/big-data-analytics-for-defence (accessed 03 Mar, 2019).
[24] (Symon and Tarapore 2015) p. 2.
[25] Paul B. Symon and Arzan Tarapore, "Defense Intelligence Analysis in the Age of Big Data," *Forum*, no. JFQ 79 (2015). https://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-79/jfq-79_4-11_Symon-Tarapore.pdf.

under high surveillance with the freedom to tap phones and feeds of any person living in Israel. Even with all that surveillance, one Shit Bet representative discussed that some how one day they missed a cross load of explosives, which then resulted in a bombing attack on a local transport bus.[26] Although Shin Bet's extreme methods of intelligence gathering have been questioned by the international community, they still had information gaps that led to attacks on Israeli citizens.

In the spring of 2018, the biennial exercise Trojan Footprint focused on "the establishment of multinational mission command structures and the integration of SOF and conventional forces."[27] This exercise included "special operations forces from: Belgium, Canada, Denmark, Estonia, Germany, Latvia, Lithuania, the Netherlands, Norway, Poland, and the U.S., as well as the armed forces of Sweden and the U.K."[28] During this exercise, NATO and US SOF were trialing a new common operating platform that could integrate intelligence information live for all users to exploit. This new platform proved to be quite useful for all intelligence operators as well as other J codes. Each end user was able to see information being geospatially populated on the platform. It was easy to see enemy force movements and disposition, friendly force movements and disposition from anywhere in the AOR during the exercise, as long as you were able to link into the network.[29] Although this was a new platform being trialed for the first time, the benefits that the intelligence

[26] *The Gatekeepers,* directed by Dror Moreh Sony Pictures Classics, 2012)
[27] Michael Weisman, "NATO, Partner Spec Ops Forces Rapidly Deploy for Trojan Footprint 18," *Air National Guard* (June 12, 2018). https://www.ang.af.mil/Media/Article-Display/Article/1548092/nato-partner-spec-ops-forces-rapidly-deploy-for-trojan-footprint-18/.
[28] Michael Weisman, "NATO, Partner Spec Ops Forces Rapidly Deploy for Trojan Footprint 18," *Air National Guard* (June 12, 2018). https://www.ang.af.mil/Media/Article-Display/Article/1548092/nato-partner-spec-ops-forces-rapidly-deploy-for-trojan-footprint-18/.
[29] I deployed on Ex Trojan Footprint 2018 as the SOF J4 Rep from Canada and was able to see this platform's utility live.

community on the exercise received from being able to integrate and share data with all international SOF allied forces, was exponential. Creating extensive analytical platforms that could provide mission analytics as well as integrating a common operating picture for all troop contributing nations could create enormous potential for generating great insight on any future battlefield.

**Act**

Through the discussion of the use of analytics across the operation functions of Sustain, Shield and Sense, it will be imperative that the analytical platform created for defence have the capability of integrating information across all the operational functions that could then lead to a greater picture informing the Act Operational Function. The Act Operational Function "integrates manoeuvre, firepower, and information operations to achieve desired effects."[30] As technology advances, the level and severity of potential threats become increasingly complex. Furthermore, modern warfare pushes for democratic societies to conduct war efforts with greater responsibility and prudency towards civilians, infrastructure and environment. There is an attempt to ensure that modern warfare strives be more humane and in line with international laws of armed conflict.[31] As a result the Operational Function of Act will be pushed towards developing a robust targeting capability that is accurate and precise.

With the emergence of the cyber domain, modern warfare has moved towards the use of both lethal and non-lethal means to achieve effects. In order to be effective in minimizing

[30] Department of National Defence, *Canadian Forces Joint Publication*, CFJP 3.0 ed.Colonel R. Ken Chadder, OMM, CD, 2010).
[31] (Ducheine, Schmitt, and Osinga 2016) P. 15

collateral damage to civilians and civilian infrastructure, deliberate targeting is becoming increasingly more important. However, what comes with targeting is the responsibility to strike a specific asset or person or group of people with such precision that there is no room for error. Going back to the film the Gatekeepers, one of the Shin Bet representatives discussed that they had faulty or inaccurate information on a particular strike, resulting in the wrongful killing of innocent people.[32] As targeting becomes more important in warfare, the emergence of analytical platforms that can help achieve the precise predictive and prescriptive technology will also become more important. "Targeting's evolutionary process is one of solving technical and informational obstacles to finding and hitting targets."[33] In the previous section, Sense, we discussed a common operating platform (COP) that can integrate operational processes with intelligence information. COP tools that can provide mission analytics would assist with the process of targeting in the sense that it could contribute to the development of accurate and precise information. The "U.S. Defense Department is leaning forward by investing in capabilities that equip U.S. cyber forces with a warfighting platform to achieve, maintain and defend cyberspace superiority."[34] The U.S. Defense Department says that this unified platform "will be a linchpin in the significant advancement in the command's ability to function with the speed, agility and precision that it requires to counter threats."[35] It would be imperative that the CAF explore similar warfighting platform analytical technologies. Through the use of prescriptive technology an analytical platform could provide

[32] *The Gatekeepers,* directed by Moreh Sony Pictures Classics, 2012)
[33] Paul A. L. Ducheine, Michael N. Schmitt and Frans P. B. Osinga, *Targeting: The Challenges of Modern Warfare* (Netherlands: Asser Press, 2016).
[34] Maj Gen Jim Keffer, Col David Hathaway and Lt Col David Weissmiller, "The Cyber Edge: Unified Platform Unifies Cyber Warfighting," *Signal* (July 01, 2018). https://www.afcea.org/content/unified-platform-unifies-cyber-warfighting.
[35] Maj Gen Jim Keffer, Col David Hathaway and Lt Col David Weissmiller, "The Cyber Edge: Unified Platform Unifies Cyber Warfighting," *Signal* (July 01, 2018). https://www.afcea.org/content/unified-platform-unifies-cyber-warfighting.

greater insight in terms of the outcome of any particular strike with greater accuracy, allowing a targeting organization to make decisions digitally observing the outcome of each decision in virtual reality. Thus, allowing for the best possible decision to be made when the actual physical strike occurs.

**Command**

Command is the operational function that thrives through the use of information that comes from the previous operational functions discussed. It "integrates all the operational functions into a single comprehensive strategic, operational, or tactical level concept."[36] Recall in the previous section the five value cases that have been identified by DPA. The last Value Case is Force Posture and Readiness (FP&R). This value case speaks to the ability for Command to truly understand the disposition of all fighting forces and resources at their disposal. The Canadian Forces does not have the luxury of creating an endlessly large military force with massive defence spending. The resources and funding are limited. Canada must work to deliberately allocate those resources to create the best possible strategic effect given the circumstances. For example, a "navy destroyer can intercept an ICBM, intervene to prevent an act of piracy, defend against certain cyberattacks, be a first responder to a natural disaster, and provide presence in contested waters. But it cannot do all those things at the same time."[37] Command must make the difficult decision to either prioritize effects or provide one effect over the other based on the situation and intent of the Government. In order for Command to have information that pertains to Force Posture and Readiness, it would require information on the following areas or pillars: Personnel, Equipment, Training, and

[36] (Department of National Defence 2010)p. 1-6
[37] (Houser and Johnson 2017)p. 4.

Ammunition (PETA).[38] The first pillar, Personnel, speaks to all J1 Code information, essentially Human Resource Information. Currently there are many different platforms that manage Personnel information. The newly introduced Human Resource Platform Guardian houses most of the human resource information that used to be managed by the Human Resources Management System (HRMS). Yet there is other personnel information held in Personnel Electronic Records Management Information System (PERMIS), which holds information such as older Personnel Evaluation Records, Medical Status and fitness status among other pertinent information. Additionally, there is the Career Management Information System (CMIS) which also has personnel information in terms of job postings, preferences and career manager notes and remarks during interviews. There are many other different platforms that manage personnel information such as the pay system and the medical information system. Given all these platforms just for one pillar, it can easily be seen that in order to conduct any particular value case resolution regarding personnel, it would require the tedious task of cross-referencing information on various different databases. Therefore, the use of an analytical platform that could integrate these databases and provide the capability of not only having greater visibility on all the data, but also the ability to manipulate the data to provide meaningful insights. These insights could uncover key information. For example, if an individual had been deployed repeatedly over the last five years and had not expressed any stress to the career manager, yet the career manager could have the ability to look at the individuals trend analysis. Perhaps over the last two years of those five years the individual may have had an increase in sick days. Given that SSE has stressed the People First, Mission Always mindset, an analytical platform would provide the ability for managers and leaders to

[38] These pillars for Force Posture and Readiness was developed by Defence Program Analytics as a means of measuring the readiness state of the forces.

take care of their subordinates and members with greater awareness. This discussion was an exploration of just one pillar of the FP & R value case. Each pillar could be explored in great length as to the potential value cases that would ultimately aggregate to useful information that would inform the greater FP & R Value case.

Although this was a brief discussion on how analytics could benefit each operational function, it would be imperative for future research to be conducted in further depth on the possibilities that could be created through the use of an integrated robust analytical platform. Each Operational Function would have extensive value cases, that once solved through the use of analytics, could provide a more effective and forward-thinking defence force.

# CHAPTER 4 - SUSTAIN DEEPER DIVE

To further demonstrate the value cases that a robust analytical platform could resolve for defence, we will have a further look at two value cases within the operational function of Sustain. These two problem-sets or value cases are: The Journey and Sustain Effects in International Missions.

## The Journey and Analytics

The first value case is in regards to a major project in CAF underway entitled, "The Journey." Currently this project is in its research phase and no particular campaign plan has yet been designed. However, the premise behind this project is in line with one of SSE's main focus which is "people."[39] The term Journey essentially refers to the entire career of a military member from the recruitment process to career management to retirement and post military care.[40] The Journey aspires to create a new and modern model of employment for CAF members that is both flexible and conducive to personnel preferences as they progress through their careers. The Journey is supposed to take into account generational differences and adapt employment models that would assist with the CAF's ability to recruit the desired amount of quality candidates and retain its members to their compulsory retirement age. The Op Generation portion within the Journey refers to that initial stage of a CAF member going from initial recruitment to the point in which the member is able to be gainfully employed in their occupation. We will begin the discussion on how analytics can assist the implementation of the Journey by first discussing in depth the Op Generation portion of the journey.

---

[39] National Defence, *Strong, Secure, Engaged: Canada's Defence Policy*,[2017]).
[40] Stephen J. Thorne, "CAF Needs to be More Diverse, Says General," *Legion: Canada's Military History Magazine* (Jun 19, 2017). https://legionmagazine.com/en/2017/06/caf-needs-to-be-more-diverse-says-general/.

Op Generation and Analytics

The Op Generation portion of the journey pertains to the attraction, enrollment and initial training of a member up to Operational Functional Point (OFP).[41] The CAF recruitment and retention to OFP has been identified as in effective. From 1992 to 1997 the CAF went through a force reduction from 90,000 to 60,000.[42] Although the appetite is to now grow the forces, there has been difficulty for the CAF to recover from the force reduction atmosphere and grow the force to desired targets. Analytics and business intelligence platforms would be a useful means to uncover some of the bottlenecks and underlying issues that are preventing the CAF from increasing its force to the desired strength. The Office of the Auditor General (OAG) recruitment and retention reports in 2002, 2006 as well as in 2016 have indicated that the recruiting targets in CAF fell short of the needs of the organization.[43] Shortages have been felt throughout the majority of the occupations, leaving many positions unfilled or vacant. Furthermore, the CAF seems to be experiencing a greater attrition rate than the recruitment rate. Canadian population dynamics have changed. Younger generations seek to find jobs that create a balanced life and seem to be less loyal to institutions like the Canadian Armed Forces. Perhaps traditional passive methods are no longer working and have become obsolete. Modern society has changed over the years and the values and principles that attract and keep a workforce has changed. New and modern methods must be sought to meet recruitment and retention objectives going forward. One of the main goals of the new defence policy SSE is to modernize and improve the recruitment process to attract and retain the right people as well as

[41] J. Vance and J. Thomas, *Op Generation - CDS Directive*National Defence,[2018]).
[42] "ARCHIVED - Changes to CF Recruiting." *Government of Canada*, no. BG-01.007 (Mar 23, 2001). http://www.forces.gc.ca/en/news/article.page?doc=changes-to-cf-recruiting/hnmx19p2.
[43] Office of the Auditor General of Canada, "Report 5—Canadian Armed Forces Recruitment and Retention—National Defence," (2016). http://www.oag-bvg.gc.ca/internet/English/parl_oag_201611_05_e_41834.html.

to grow the force to its desired strength.[44] Currently, the recruitment method is a passive approach. The current process is to create recruitment drives then wait for applicants and then draw the most suitable candidates from those applicants. With the additional increase in military spending of $2.5 million per year as stated before, there is also an appetite to grow the force from its current strength. The Joint Directive on OP Generation that was published in May 2018, identified that the main goal for Commander Military Personnel Command will be to solicit the assistance of DND/CAF elements "to generate a force of 101,500 talented and diverse members who are prepared to meet the challenges of our rapidly evolving security environment."[45] This desired target for force strength is expected to be achieved by 2026. Within the newly identified force strength target there was also specific goals laid out in terms of diversity: 25.1% women, 11.8% visible minorities and 3.5% indigenous peoples. This document is assuming that the start state of the forces is at the current desired authorized state which is 68,000 regular force members and 28,500 reserve force members. Based on that assumption, in order to achieve the desired force strength by 2026 as indicated in SSE, the CAF would have to grow by 5000 members (3,500 regular force and 1,500 reserve force members). This seems to be, with all else being equal, a reasonable growth pressure. To grow the forces to 101,500, CAF would require the recruitment of roughly 714 members per year. However, in order to determine the actual number of members that would be required for recruitment, the attrition rate would also have to be considered. Although it was difficult to find the actual percentage of attrition from the CAF, various source documents from Director General Military Careers (DGMC) pointed to a number ranging from 7.1 – 9.1 % or higher

[44] National Defence, *Strong, Secure, Engaged: Canada's Defence Policy*,[2017]).
[45] Vance and Thomas, *Op Generation - CDS Directive*National Defence,[2018]).

depending on the occupation. Some occupations have attrition rates as high as 10%.[46] Calculating the attrition rate with possible percentages at 7.1% to 9.1% would mean that the CAF is losing 4,828 to 6,188 members per year. Therefore, the actual pressure for recruitment would be between 5,542 and 6,902 members per year in order to achieve the desired force strength. The below figure is an illustration of the regular force enrolments for FY 17/18 given from Director General Military Careers (DGMC).

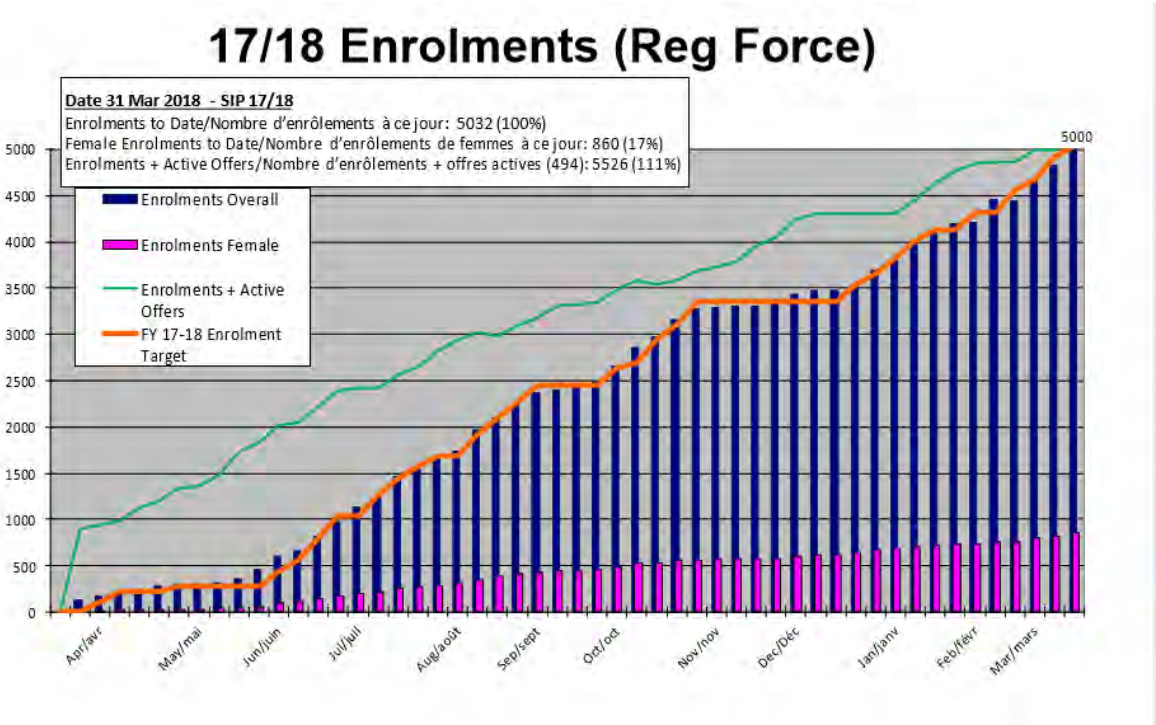



Figure 4.1[47]

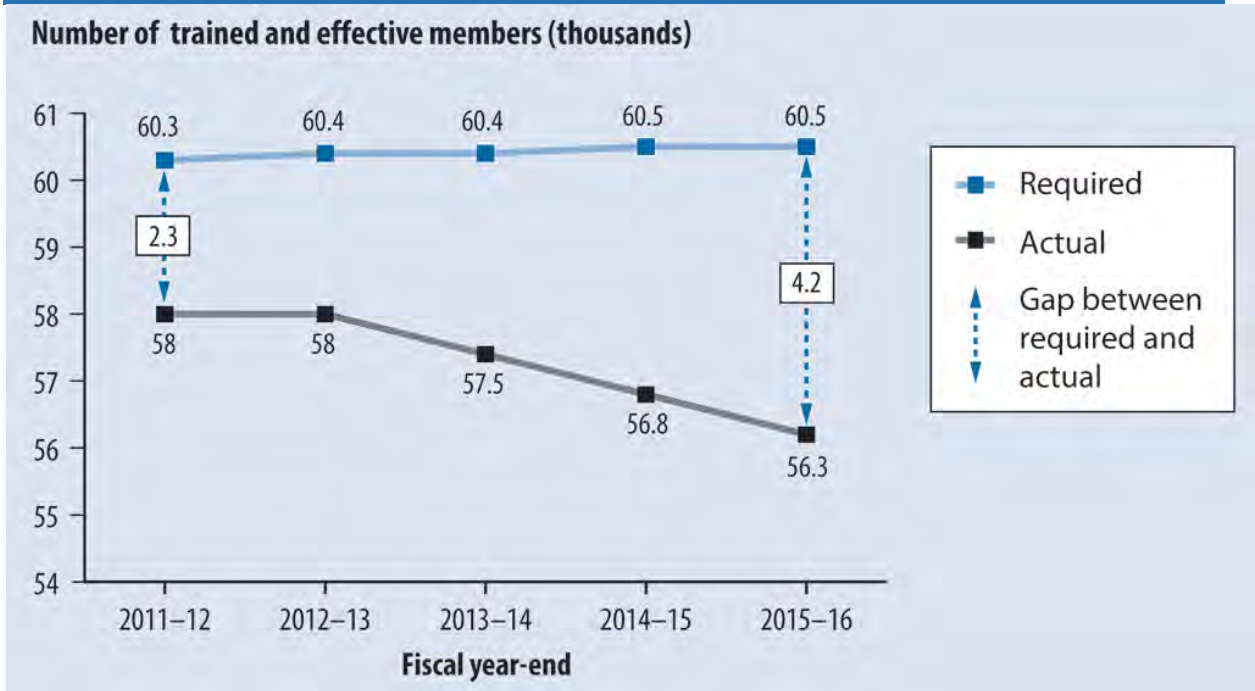
Looking at the above figure it seems that last year they were able to recruit roughly 5032 members which is below the target range calculated (5,542 and 6,902). In the above illustration it is also interesting to note that the number of women enrolled in the year is also

[46] Percentage drawn from CMIS data extraction Sept 2018
[47] Figure is taken from CFRG presentation on recruiting women, fall of 2018 received from DGMC.

well below the target. Furthermore, the initial assumption that the current strength of the forces is already at today's desired state, would be a false assumption. In the Office of the Auditor General (OAG) Report on Canadian Forces Recruitment and Retention in 2016, the CAF Regular Force target was to reach 68,000 by the year 2017/18. Yet the actual regular force numbers came in at 60,500 at that time.[48] The OAG also reported that the numbers were on a steady decline as the attrition rate was higher than the recruitment rate.[49] See below figure from OAG report for illustration.

## Annex A

**Exhibit 5.1—The gap between the required and actual numbers of trained and effective Regular Force members increased from about 2,300 at the end of the 2011–12 fiscal year to about 4,200 at the end of the 2015–16 fiscal year**




[48] Office of the Auditor General of Canada, "Report 5—Canadian Armed Forces Recruitment and Retention—National Defence," (2016). http://www.oag-bvg.gc.ca/internet/English/parl_oag_201611_05_e_41834.html.
[49] Office of the Auditor General of Canada, "Report 5—Canadian Armed Forces Recruitment and Retention—National Defence," (2016). http://www.oag-bvg.gc.ca/internet/English/parl_oag_201611_05_e_41834.html.

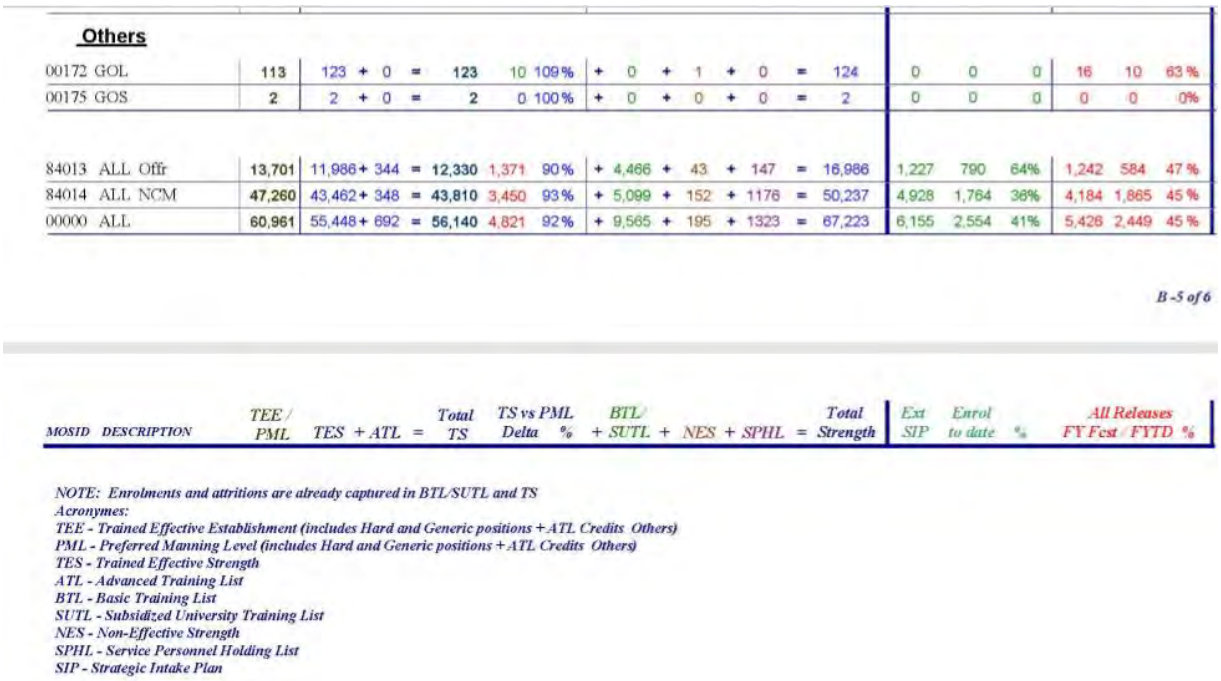
Source: Based on data from National Defence (unaudited)—numbers have been rounded

Figure 4.2[50]

The additional issues that the OAG brought forth in the above illustration is that despite the fact that the numbers were below target at 60,500, the actual effective and trained regular force members was even lower at 56,300. The gap there represents the number of untrained or ill and injured members within those numbers. Most recent reports indicate that the full-time regular force members are at 64,000.[51] The following illustration is a recent extraction from the Career Management Information System (CMIS) dated September 2018:

Trained Strength Vs Trained Effective Establishment/Preferred Manning Level Dated September 2018:

[50] Office of the Auditor General of Canada, "Report 5—Canadian Armed Forces Recruitment and Retention—National Defence," (2016). http://www.oag-bvg.gc.ca/internet/English/parl_oag_201611_05_e_41834.html.
[51] "Canada Military Strength."https://www.globalfirepower.com/country-military-strength-detail.asp?country_id=Canada



**Others**

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00172 GOL | 113 | 123 | + | 0 | = | 123 | 10 | 109% | + | 0 | + | 1 | + | 0 | = | 124 | 0 | 0 | 0 | 16 | 10 | 63% |
| 00175 GOS | 2 | 2 | + | 0 | = | 2 | 0 | 100% | + | 0 | + | 0 | + | 0 | = | 2 | 0 | 0 | 0 | 0 | 0 | 0% |
| 84013 ALL Offr | 13,701 | 11,986 | + | 344 | = | 12,330 | 1,371 | 90% | + | 4,466 | + | 43 | + | 147 | = | 16,986 | 1,227 | 790 | 64% | 1,242 | 584 | 47% |
| 84014 ALL NCM | 47,260 | 43,462 | + | 348 | = | 43,810 | 3,450 | 93% | + | 5,099 | + | 152 | + | 1176 | = | 50,237 | 4,928 | 1,764 | 36% | 4,184 | 1,865 | 45% |
| 00000 ALL | 60,961 | 55,448 | + | 692 | = | 56,140 | 4,821 | 92% | + | 9,565 | + | 195 | + | 1323 | = | 67,223 | 6,155 | 2,554 | 41% | 5,426 | 2,449 | 45% |

*B-5 of 6*

| MOSID DESCRIPTION | TEE / PML | TES | + | ATL | = | Total TS | TS vs PML Delta | % | BTL/ SUTL | + | NES | + | SPHL | = | Total Strength | Ext SIP | Enrol to date | % | All Releases FY Fcst / FYTD | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

*NOTE: Enrolments and attritions are already captured in BTL/SUTL and TS*
*Acronymes:*
*TEE - Trained Effective Establishment (includes Hard and Generic positions + ATL Credits Others)*
*PML - Preferred Manning Level (includes Hard and Generic positions + ATL Credits Others)*
*TES - Trained Effective Strength*
*ATL - Advanced Training List*
*BTL - Basic Training List*
*SUTL - Subsidized University Training List*
*NES - Non-Effective Strength*
*SPHL - Service Personnel Holding List*
*SIP - Strategic Intake Plan*

Figure 4.3[52]

In the above data extraction from CMIS as of September 2018 the actual number of Regular Force members is 60,961. This number is not much higher than the number reported by the OAG nearly three years prior. Furthermore, the actual trained and effective members number is at 56,140, which is even lower than the number reported by the OAG in 2016. If we were to use today's existing data and assume that our start state for regular force strength was at 60,961, then in order to reach 71,500 regular force members by 2026, the CAF would have to recruit [1,505 + numbers to compensate for attrition (4,828 to 6,188)] between 6,333 and 7,693 members a year to reach the desired force strength. Given the magnitude of inflow required, it would be imperative that the CAF work to uncover all the issues that is preventing the desired growth. An analytical platform capable of looking at large datasets would create

[52] Extraction from CMIS September 2018 given from Director General Military Careers (DGMC)

better fidelity as information is manipulated to expose key systemic issues that could be evolved or transformed.

Let's have a deeper look at what our current analytical platform within CAF can do. Using the Business Objects suite, the following illustration was able to be created which looks at the detailed breakdown of enrollment by profession.

Enrollments by Trade for FY 17/18:

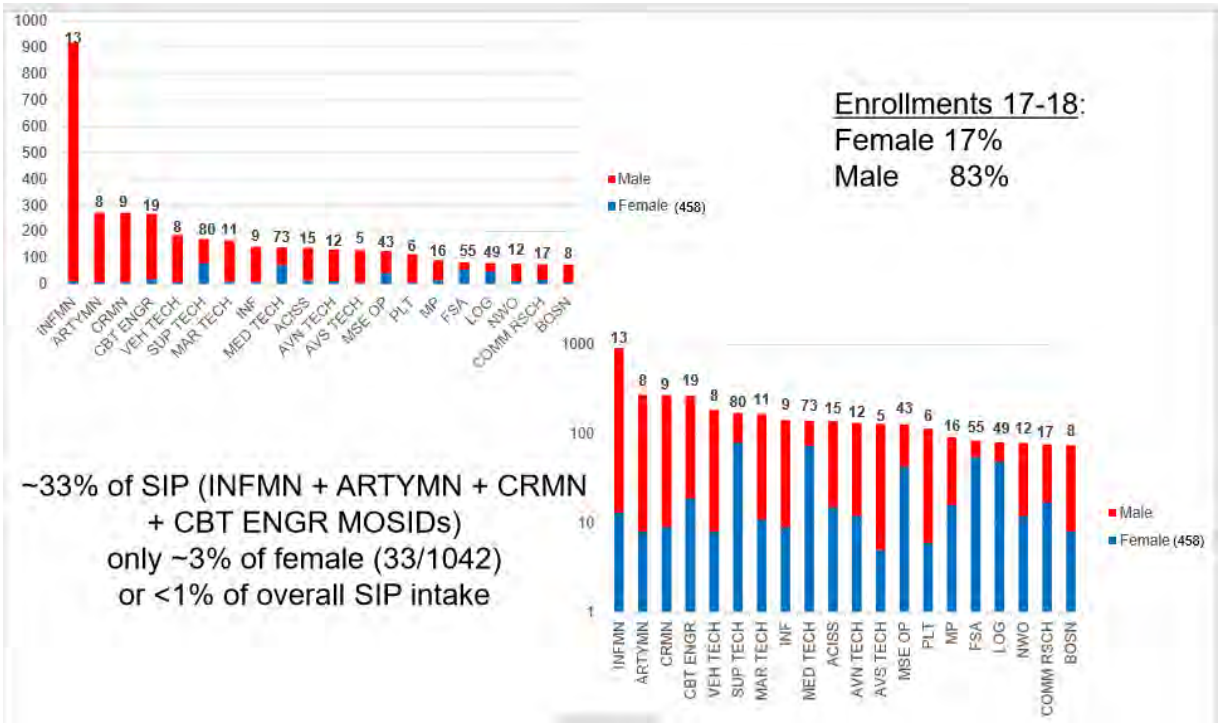



Figure 4.4[53]

As stated before within the force strength target of 101,500, there is the additional pressure to attract and retain a diverse workforce. The above illustration shows the recruitment percentage of women at 17% which is slightly higher than the current disposition throughout the forces.

[53] Figure is taken from CFRG presentation on recruiting women, fall of 2018 received from DGMC.

In the OAG report in 2016, the target for women in the workforce was set at 25%. However, the OAG found that the percentage of women was at 14%. Furthermore, the numbers of women seem to be in more traditional fields such as nurse, logistics, and other support related fields.[54] Looking closely at the combat arms professions the numbers were much lower. Figure 1.4 confirms the findings of the OAG report in 2016 with regards to the fact that there are more women joining support related trades or professions rather than combat related trades. Going back to the initial target for women in the forces at 25.1% by 2026, the CAF would have to increase its percentage of women by 1.5% every year. Although this number seems small and reasonable, both the OAG report and other recruitment and retention reports have suggested that the attrition rate tends to be higher for women than men. Therefore, the attraction and recruitment for women would have to be a deliberate effort in order to obtained the desired target. Again, having an analytical platform could help uncover fundamental issues that could be preventing the attraction and recruitment of women into the forces. The above illustrations are descriptive analytics. Having a look at our current state today and what is happening. The information derived from descriptive analytics can evolve to predictive analytics which would lead to trend analysis and forecasting. Forecasting and trend analysis can assist an organization to discover future realities that could be mitigated by instituting new processes or policies prior to those future reality timelines. To demonstrate trend analysis following illustration of the logistics trade attrition rate shows the emergence and trending derived from predictive analytics.

Logistics Attrition Rate:

[54] Office of the Auditor General of Canada, "Report 5—Canadian Armed Forces Recruitment and Retention—National Defence," (2016). http://www.oag-bvg.gc.ca/internet/English/parl_oag_201611_05_e_41834.html.

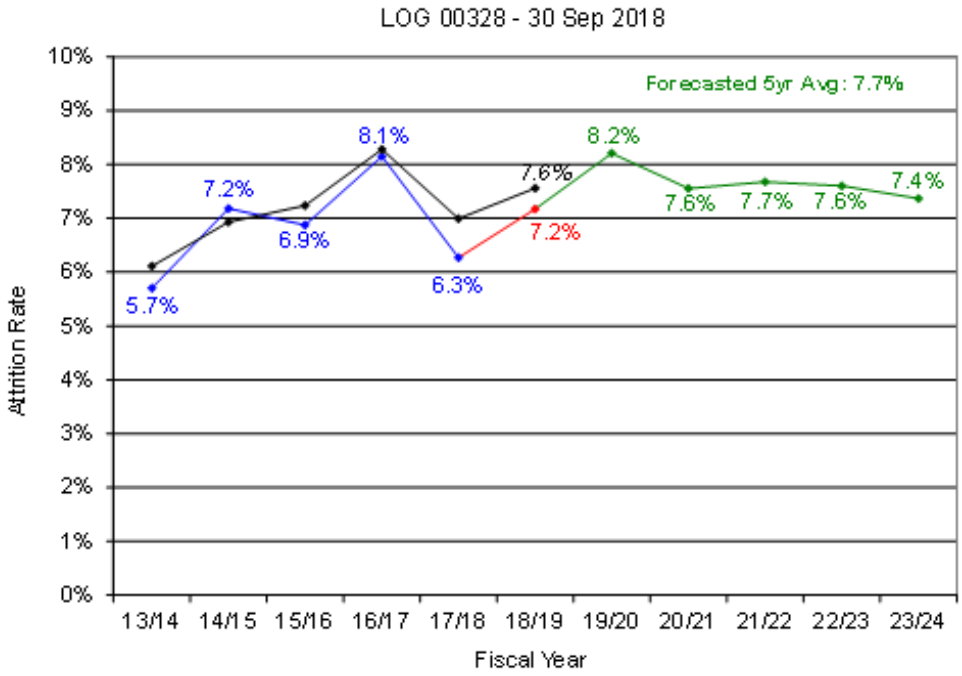



Figure 4.5[55]

In the above illustration assuming that all else is equal, the predicted attrition rate is based on an average of the historical trends. This forecasted figure can assist with the development of recruitment targets for the logistics trade in the years to come. Eventually the use of analytics can evolve to prescriptive analytics where recruitment tactics and decisions can be inputted into the system to assess future outcomes. In other words, with the use of analytics the organization blindness is removed allowing for a full discovery of the issues and problems that need to be resolved.

Going back to the data extraction from CMIS in Figure 1.3 the total number of members on the Basic Training List is 9,565. This number is astronomical. In recent analytic

[55] This figure was extracted from the Logistics Officer Career Management Brief date Fall 2018

use case resolution for the recruitment process by the Canadian Forces Recruit Group (CFRG), it was found that there were lengthy wait times from the moment a potential candidate applied to CAF to receiving contact and ultimately being offered entry. In most cases the process and wait times were over 6 months. These members on BTL could be waiting for the initial Basic Recruit training or their first Qualification Level training that would allow them to be gainfully employed. The OAG report on recruit and retention suggested that the lengthy wait times may have been a contributor to unnecessary attrition of members prior to OFP.[56] The following is an illustration taken from the OAG report depicting some of the wait times observed by CAF members.

Exhibit 5.3—Non-commissioned members in some occupations took considerable time to become fully functional, partly because of the waiting times during training

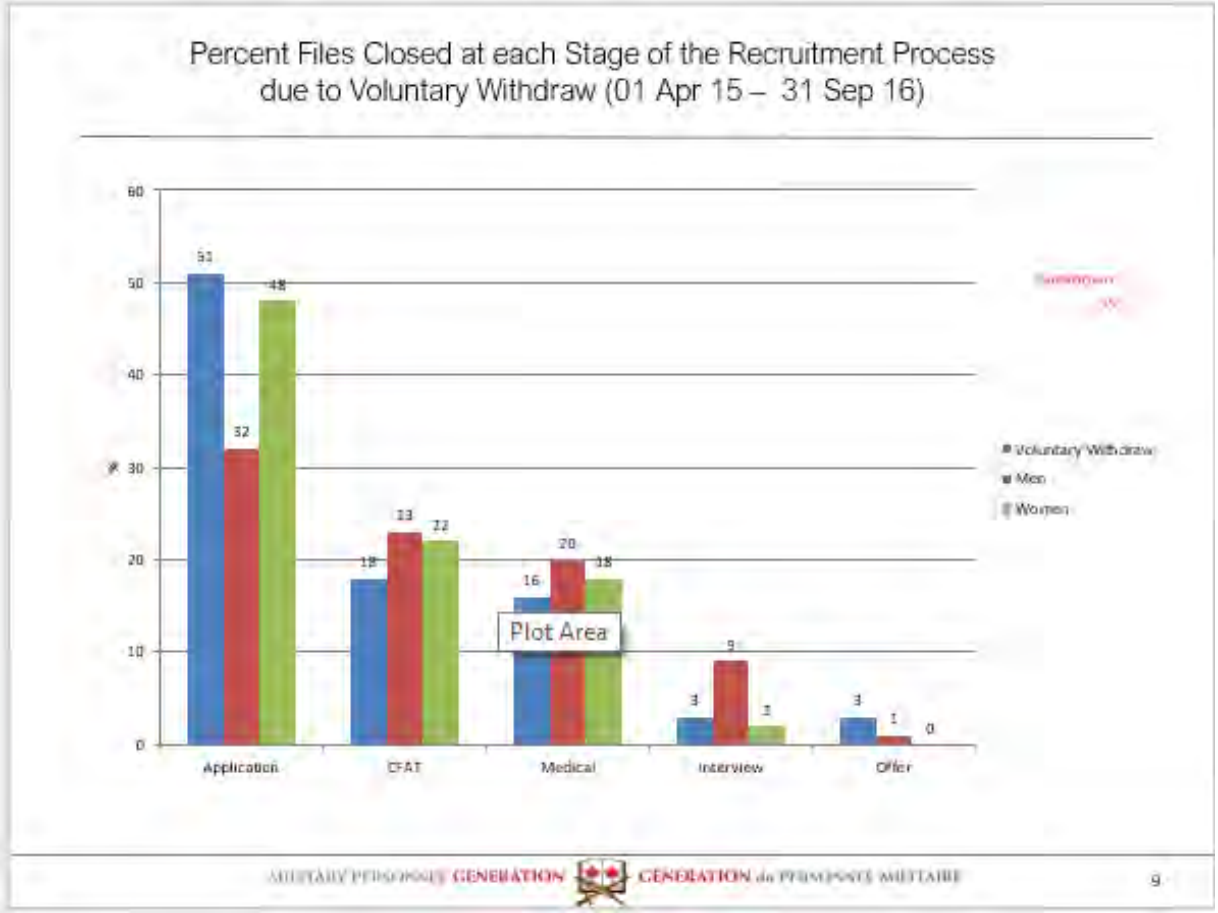
| Occupation | Average training duration (including waiting times) | Average waiting times |
|---|---|---|
| Avionics Systems Technician | 25 months | 6 months |
| Vehicle Technician | 20 months | 7 months |
| Army Communication and Information Systems Specialist | 11 months | 5 months |
| Marine Engineer | 9 months | 2 months |

Source: Adapted from National Defence data (unaudited)

Figure 4.6 [57]

[56] Office of the Auditor General of Canada, "Report 5—Canadian Armed Forces Recruitment and Retention—National Defence," (2016). http://www.oag-bvg.gc.ca/internet/English/parl_oag_201611_05_e_41834.html.
[57] Office of the Auditor General of Canada, "Report 5—Canadian Armed Forces Recruitment and Retention—National Defence," (2016). http://www.oag-bvg.gc.ca/internet/English/parl_oag_201611_05_e_41834.html.

Based on the illustration above, it can be seen that these lengthy wait times could have a direct impact on the ability for CAF to keep the interest of members. The OAG recommended that the "Regular Force must examine its methods of attracting and recruiting candidates, and training and retaining members."[58] This lengthy wait time has been found to deter potential applicants from proceeding to enter into the CAF. Then there are the potential candidates going through the recruitment process and have not yet made it to the Basic Training List. The following illustration shows the attrition during the actual entry and recruitment process.




[58] Office of the Auditor General of Canada, "Report 5—Canadian Armed Forces Recruitment and Retention—National Defence," (2016). http://www.oag-bvg.gc.ca/internet/English/parl_oag_201611_05_e_41834.html.

Figure 4.7[59]

Based on the information provided in Figure 1.6, in FY 15/16 the Canadian Forces Recruit Group (CFRG) had 10,553 unsuccessful applicants. Overall CFRG has reported that nearly 66% of applicants do not successfully navigate the recruitment process and either withdraw their application or receive no further contact.[60] In essence, the CAF's loses 66% of its applicants before an offer is even made. That is essentially 6,964 applicants that could have been suitable candidates for the CAF and could have been part of the recruitment numbers for that year. Instead they have withdrawn their applications due to the application process. Then, going back to the number of members on BTL at 9,565, these members are backlogged in the system awaiting training. Although the actual attrition rate was not calculated in the OAG report, looking at Figure 1.2 the annual attrition for members on BTL seems to be around 566 members since FY 12/13 and the system has not been able to recover from this trend.

In 2016, the OAG report addressed concerns about inadequate training capacity to deal with the influx of recruits. In a report provided as a response to the OAG report issues by National Defence in 2018, there were measures that were taken to address the issues identified by the OAG. Among those measures was to create additional permanent positions at the Canadian Forces Leadership and Recruit School.[61] Although this report was newly issued, these positions were created in 2017. Given the most recent data taken from CMIS, the BTL backlog is still quite substantial. The OAG recommended that the "the Canadian Armed Forces should develop, implement, monitor, and evaluate measures to optimize retention for

[59] Canadian Forces Recruit Group, *Tiger Team – Recruitment of Women in the Caf* (Ottawa: , 2016).
[60] Canadian Forces Recruit Group, *Tiger Team – Recruitment of Women in the Caf* (Ottawa: , 2016).
[61] Jody Thomas, *House of Commons Standing Committee on Public Accounts: Canadian Armed Forces Recruitment and Retention Response*,[2018]). p. 7

each occupation" in order to uncover detailed systemic issues. However, the location for information on attrition is currently stored on several different database platforms within DND.[62] To critically uncover systemic issues within each occupation across several different platforms could take years of research. Given the priority and timeline to increase the strength of the force, the CAF the time to conduct years of research. An analytical platform with the appropriate technical team could integrate all the databases and provide one platform that could manipulate key information to assist with the discovery of rudimentary issues that are currently prohibiting the CAF from increasing its forces strength.

Aside from the lack of ability for the CAF to generate the numbers, there is also the desire for attracting applicants with appropriate skillsets that are capable of succeeding in the military environment. In a recruitment and retention study done in 2008, they identified that "better selection decisions will result in reduced attrition."[63] In other words, if the CAF attracts the right individuals, the chances for success would be higher. Perhaps then, the attrition rate overall would be reduced. Statistical analysis of the civilian job market has determined that on average 30% of able and willing workforce are seeking jobs and 70% of candidates are not seeking or already have jobs. However, the 70% that are currently not seeking jobs may contain highly qualified talent that could be more suitable for the CAF than the ones actually seeking jobs.[64] Moving into an environment with specialized domains such as Cyber and Space as well as the world of analytics, the CAF would have to find and attract

---

[62] Nancy Otis and Michelle Straver, *Review of Attrition and Retention Research for the Canadian Forces*Defence R&D Canada - CORA,[2008]). p. v.
[63] Nancy Otis and Michelle Straver, *Review of Attrition and Retention Research for the Canadian Forces*Defence R&D Canada - CORA,[2008]). p. 32
[64] Liam Mooney, "The Difference between a Headhunter and Recruitment Consultant," (07 January, 2015). https://www.linkedin.com/pulse/difference-between-headhunter-recruitment-consultant-liam-mooney.

individuals with those specialized skillsets. Individuals with skillsets capable to operate in a Cyber environment will be on high demand, not only from Defence organizations but from large corporations as well. The key here would be that the CAF would have to find a way to become just as attractive or more attractive in order to compete with the other jobs available on the market. Corporations seeking specific skillsets use head hunting tactics to find and seek the right individuals. Perhaps the CAF would need to look at the ability to create a more targeted approach to recruitment. Going back to the discussion about 70% of people who are able to work and not seek jobs versus the 30% seeking jobs. It is possible that the people with the qualities and skillsets required are sitting in the 70% pool of candidates. How can the CAF access this pool? According to current statistics, the Canadian Population is at over 35 million. Of this population 16 million are part of the capable workforce and it is estimated that 13 million people are potentially fit for service. Additionally, it has been assess that 427,524 people each the age for military service annually.[65] Given those statistics, 3.9 million people within Canada would be part of that 30% seeking jobs. 9.1 million people would be part of the pool not seeking jobs. Given this information, it seems reasonable to expect the CAF to have the ability to recruit between 6,000 and 7,000 members annually. The fact that this has not been attainable reveals that the inability to recruit is not stemming from the lack of availability. The issue most likely has many other variables that are impacting the recruitment process.

Analytical platforms with the capability to integrate recruiting and onboarding software is extremely useful for the development of targeted recruitment strategies. For

[65] "Canada Military Strength."https://www.globalfirepower.com/country-military-strength-detail.asp?country_id=Canada

example the SAP Recruiting software helps "engage the right talent with a solution that provides metrics and guidance at every step of the recruitment process – from sourcing and candidate experience to applicant tracking."[66] According to the HR Technologist website, "hiring top talent is not just about filling vacancies anymore, organizations need to build predictable talent pipelines and keep prospective employees engaged to deliver the best ROI on talent acquisition."[67] Appropriate recruiting software can assist in managing information such as demographic and generational trends. For example, there are many sources out there that discuss how generational differences are occurring much faster due to the information age. The millennial generation has been known to care less about money and more about jobs that have meaning. In contrast, the Generation that is emerging after the millennials, "Generation Z" seems to have more of an affiliation towards job security and finances. The general trend from Generation X onward has been to ensure that there is an appropriate work/life balance is achieved.[68] These trends and differences can be placed in a People Analytics platform to help inform the success or failure of particular decisions. In the case for military recruiting, finding what makes a particular generation interested will be the key to remaining an attractive employer among the competition. In the book entitled *People Analytics in the Era of Big Date* it states that "with the increase of new media and multitude of ways to interact online, comes the increase of new data into the recruiting organization and the building blocks of People Analytics"[69] Overall the Op Generation portion of the Journey will

[66] SAP, "SAP Recruiting and Onboarding," https://www.sap.com/canada/products/human-resources-hcm/recruiting-onboarding.html (accessed 12 October, 2018).
[67] Sushman Biswas, "4 must-have Features in a Recruiting and Onboarding Software System <br>," *HR Technologist* (Aug 02, 2018). https://www.hrtechnologist.com/articles/recruitment-onboarding/4-musthave-features-in-a-recruiting-and-onboarding-software/.
[68] Deep Patel, "8 Ways Generation Z Will Differ from Millennials in the Workplace," (accessed 12 Nov, 2018).
[69] Isson and Harriott, *People Analytics in the Era of Big Data* (New Jersey and Canada: John Wiley & Sons, Inc., 2016).

be critical to the success and sustainment of the Canadian Armed Forces as an institution. Using an analytical platform that can uncover key process issues and demographic trends will not only help understand the current state of the institution but is can also help lead the organization towards future models that fit the evolving society.

The Journey Discussion

As stated before, the Journey is about the entire process of recruiting a member into the CAF through to career management and finally retirement. For this portion of the discussion we will concentrate on career management. Currently, there are three databases that manage information regarding personnel and occupational positions: Guardian, CMIS and PERMIS. Guardian is the newest HR management system that has been adopted by the CAF in the fall of 2018. The CAF organizations are still in the learning stage, however this tool seems to be fairly user friendly and in terms of interface, is very similar to the DRMIS platform.[70] CMIS on the other hand seems to be more like an Access database platform that houses similar information to Guardian but also has the capacity to speak to the third system, PERMIS. CMIS also has career manager remarks for interviews as well as fairly robust query capabilities for information regarding manning and positions within each occupation and element. PERMIS has extra information such as past PERs and PER scores, medical limitations and administrative review information. To manage a member's career, the CM will be required to cross reference each one of these databases to ensure that they are fully informed on the individuals they are managing. This can be extremely complex when a CM is required to manage 800 to 1000 individuals. The CMIS platform actually has the capability

[70] The author has been on the system for training to prepare for Career Manager Job upon completion of JCSP.

for career managers to digitally create posting plots, however the majority of CMs currently working at DGMC utilize excel spreadsheets for planning purposes. After looking through the digital posting plot capability, one key area of information seemed to be mission. Although all the position names, numbers and geographic locations where available, the information regarding the scope of those positions was not available. In other words, the terms of reference or required qualifications were not identified. Even if a position was marked as a succession planned position, there was no indication on any of the databases the qualifications or experiences that would benefit a member by working in that particular position. Without this information it seems as though the posting plot is managed based on holes to plug and moves authorized rather than having a clear understanding of a particular path an individual within an occupation would make. Perhaps in the spirit of the journey, the career management process would require complete transformation.

The current employment process within the CAF is traditional in terms of requiring an individual to move from their position every 2 – 3 years, especially for officers if they desire career advancement. The current career management databases would not be able to support a new and modern employment model that would allow for complete flexibility. Given new analytical technologies, there is a way to create a platform that could integrate detailed jobs information, career pathways for succession planning and career advancement and take into account People Analytics to formulate a job to individual matching capabilities. An analytical platform with the appropriate onboarding software that can integrate personnel information with institutional position and occupation information, would be the ultimate platform that could support a modern and flexible employment model. These types of onboarding platforms work very similar to dating websites. Each job or position that is created has a profile with the

list of all the qualifications required, job experience, and even personality type preferences. Similarly, each individual would have their profile created with all their qualifications and experiences as well as their personal preference in terms of family requirements or flexibility. The system also has the capability to include career pathways. For example, one could map out the entire career process to get to the positions of Chief of Defence staff along with all the potential positions, job experiences and types of personalities required to fill these positions. Then perhaps a year prior to the APS season, allow the platform to run its algorithms and determine the best possible matches.[71] The organizations expecting a new member as well as the career manager would then received the top ten suitable candidates for each position. Similarly, each individual expecting to be posted would receive their top ten list of suitable positions based on their preferences, job experiences and career advancement intentions. Based on those top ten picks for both the organization and the individuals, the career manager can then guide the members into the best suitable position that would support both the individual's goals as well as the goals of the institution.[72] Although this type of management software seems unattainable, People Analytics and Recruiting and Onboarding software is making this type of platform possible. This platform would also support the flexible and modern employment model that the Journey desires. Each member of the forces would have a sense of autonomy over their own careers as they would be closely be involved in the process

[71] B. V. Textkernel, "Match!" *Textkernel* (2019). https://www.textkernel.com/hr-software-modules/match-cv-to-jobs/.

[72] Although a platform like this for Defence Career Management does not exist, there are powerful platforms like this that could support this type of model. The author of this paper spoke to a member of the Denmark SOF, who revealed that Denmark is working on transitioning to a model like this over the next 5 years. The author also had lengthy discussions with SAP who insisted that the creation of such a model would require some effort on the front end, but could be achieved fairly rapidly.

and decision making of each job posting. Although a platform such as this is yet to be trialed and tested, perhaps Adam's Smith's description of the invisible hand could prove to be true.

> *By preferring the support of domestic to that of foreign industry, he intends only his own security; and by directing that industry in such a manner as its produce may be of the greatest value, he intends only his own gain; and he is in this, as in many other cases led by an invisible hand to promote an end which was no part of his intention. – Adam Smith, The Wealth of Nations*[73]

This type of platform would also assist with all the recruiting challenges and problems discussed earlier. Recruiting and Onboarding software come with an extensive applicant tracking system.[74] This integrated system could potentially allow for a more decentralized approach to recruitment. Perhaps each unit or organization nation wide could be given the responsibility to attract and recruit individuals from the local vicinity. As each application is received, it could then be entered into the onboarding system that would have the capability of sharing the application information across all organizations.[75] Recall the discussion about the pool of people fit for military service but are part of the 70% not seeking jobs, a recent report published by the HR Technologist entitled *Recruitment and Onboarding Tools Usage Trends Report/2018*-19 stated that "92% of candidates say they would consider leaving their current jobs if a company with an excellent corporate reputation offered them another role." [76] A People Analytic platform in conjunction with the appropriate recruiting and onboarding software could allow for a targeted recruitment model. People Analytic platforms have the

[73] Adam Smith, ed., *The Wealth of Nations<br>* (New York: Modern Library 2000, 1776).
[74] . *RECRUITMENT & ONBOARDING TOOLS USAGE TRENDS REPORT | 2018-19*,[2019b]).
[75] . *RECRUITMENT & ONBOARDING TOOLS USAGE TRENDS REPORT | 2018-19*,[2019b]).
[76] . *RECRUITMENT & ONBOARDING TOOLS USAGE TRENDS REPORT | 2018-19*,[2019b]).

capability to search unstructured data sources such as LinkedIn, Facebook and job resume databases, uncovering candidates that have specific skillsets and characteristics. Going back to the discussion on the dynamics of generational preferences, these technologies are also being developed to understand behavioural economics. [77] The CAF would require extensive alliance with industry to develop a tool that could support the transition of an old and taxing employment model to one that is forward thinking and proactive to changing generations.

**Effects of Sustainment in International Missions**

The second sustainment value case that requires resolution through the use of analytics is the effects of conducting sustainment operations in international missions. Currently, it is unknown what the impact of sustaining forces for prolonged periods of time in international areas of operation. For example, a force deploying to a warfighting zone would require extensive sustainment services. In Afghanistan, many of the coalition camps had locally engaged contracts with local suppliers for food, water and fuel as well as rental cars and construction supplies. The economic expenditure of forces in the region is perhaps a political act to help stimulate the local economy to provide a more stable environment. However, at this point in time we do not really have a grasp in terms of the impact of sustainment operations have in the area of operation. In other words, what is the economic impact on the country from the false influx of economic stimulation? What does this influx of money do to the affected region, does it assist or hurt the local economy? Furthermore, how can sustainers be sure about who they are contracting with? Could there be a correlation between the money being spent for sustaining troops and the ability for the enemy force to attain deadly weaponry

[77] David Swanz, "Harnessing the Power of Behavioral Economics in Talent Acquisition," *HR Technologist*, no. Recruitment and Onboarding (May 02, 2019). https://www.hrtechnologist.com/articles/recruitment-onboarding/harnessing-the-power-of-behavioral-economics-in-talent-acquisition/.

and supplies? Sustainment of missions costs millions of dollars and the majority of these dollars go to local companies. During out time in location these companies thrive on the steady flow of money from international troop contributing nations. What happens when this influx of money disappears? How do the local companies recover from this? During the mission transition period in Afghanistan, many of these companies expressed concern for their livelihood prior to Canada returning the majority of their forces. What if analytics could help uncover all the issues surrounding the sustainment effects in international mission. Going back to the exercise Trojan Footprint that occurred in the spring of 2018, the common operating platform that was being trialed, allowed for the capability to do geographic searches for supplies and freight companies. It allowed for the sustainers to look for normal economic means of transporting supplies without increasing or decreasing the normal economic patterns of the region. Furthermore, the platform was capable of investigating contractor background and affiliations. The system was able to search on all structured and unstructured data sources to determine the potential networks of a contractor providing sustainment goods and services. Perhaps as we build the logical intelligence capability, the forces could be more deliberate and forth coming about when, where and with whom the government money is spent. Perhaps the efforts of sustainment could be deliberately part of the Act operational functions as it could assist with potential targeting information. For example, in SOF it would be conducive to seek and find information regarding the networks and affiliations of individuals that are being tracked. Perhaps if there was a way to track financial transactions post payment in the local region, these networks could reveal some information extremely pertinent to the targeting process. Analytical platforms are developing the capability to track human behaviour. The CAF should explore the possibilities.

# CHAPTER 5 - TARGET ARCHITECTURE CONCEPT AND ANALYTIC USE CASE RESOLUTION

The development of an analytical platform that is capable of integrating data and information that can be easily used to inform all the operational functions would require extensive research and assistance from industry. Although the CAF is a complex organization, many other non defence related business such as Amazon, Google and iTunes have managed to create innovative platforms that continually evolve their businesses. In this section we will discuss the possible target architecture concept and the analytic use case or value case resolution methodology.

Analytical technologies and platforms are evolving rapidly. In order to ensure that the CAF implements the correct platform, it would involve extensive research and collaboration with industry and corporations already involved in analytic platform development. Given that this is an emerging technology, "it is still changing; the sources are still evolving."[78] The current target architecture for analytics on the business enclave DWAN platform contains a business warehouse and business object model. The business warehouse requires the use of Bex Queries which are essential snap shots of information from the original source databases that is not in real-time. The following illustration is an image of what our current architecture looks like on the left and then on the right an overview of what the target architecture could look like.

[78] McKinsey and Company, "How Companies are using Big Data Analytics," (April, 2016). https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/McKinsey%20Digital/Our%20Insights/How%20companies%20are%20using%20big%20data%20and%20analytics/How%20companies%20are%20using%20big%20data%20and%20analytics.ashx.

Current Analytic Architecture Vs Potential Architecture

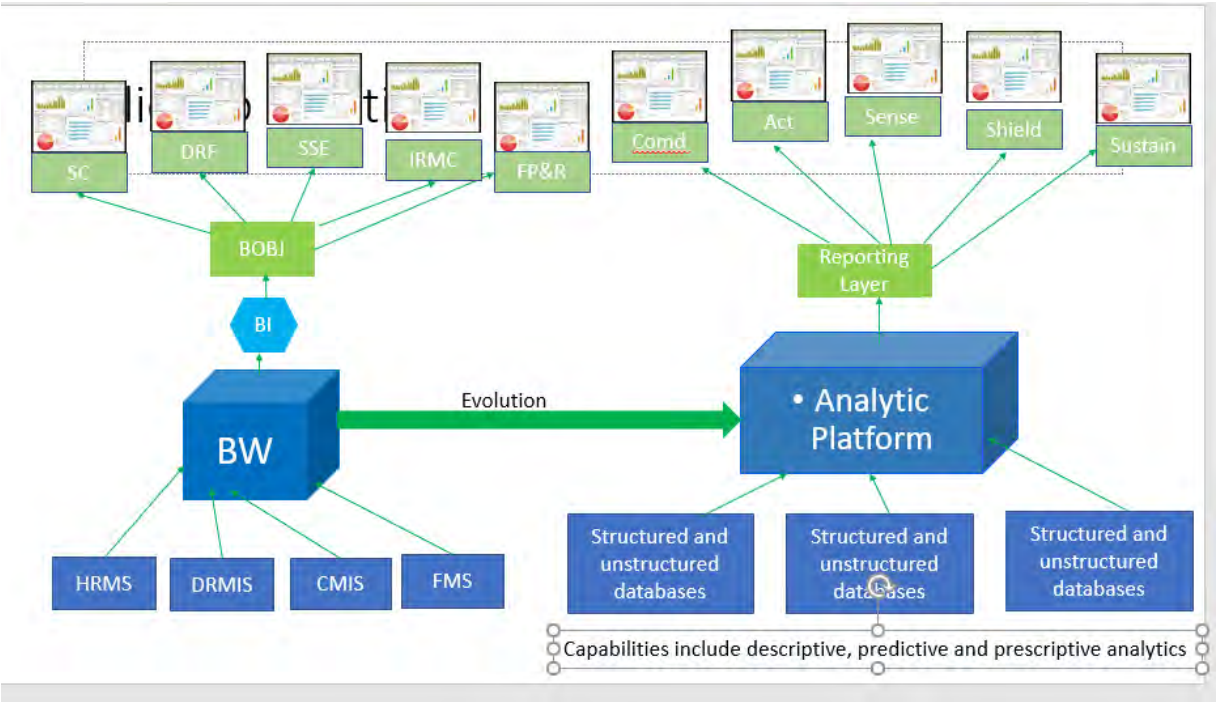



Figure 5.1[79]

Reviewing the illustration above, the analytic platform on the right is the newly emerging analytic platform technology that is capable of integrating big data across all structured and unstructured data. These platforms only require data modeling but do not require the use of Bex Queries or snapshots of the databases. This platform is able to bring information live into memory allowing for the analysis to be conducted in real-time.[80]

Along with the target architecture there would also be a requirement to ensure that there is an appropriate team of experts capable of looking at the CAF business processes across all operational functions. This team of experts would include the following types of

[79] This image was created in PowerPoint as a depiction of what was discussed with SAP as potential options.
[80] Information about these platforms has been attained through discussions with SAP

personnel: platform solution architects, data scientists, report developers, security experts and many more. Many of these experts already exist within the Defence Program Analytics organization. With the annual increase in spending, it is likely that this organization will continue to grow as new requirements in digital transformation is realized.

To finalize the discussion on Target Architecture and methodologies, SAP recommended that a stacked approach to value case resolution would be the best way to ensure that the CAF generates success early and often. The premise behind frequent success is discussed in greater detail in Chapter… This stacked approach is in line with the concepts discussed in the book entitled *Transforming Leaders Into Progress Makers: Leadership for the 21st Century* by Clampitt and DeKoch's.,[81] Normally the CAF would be inclined to conduct such a transformation through a linear phased approach. For example, phase one could be communication of the plan, phase two resolve all sustainment value cases, phase three resolve all shield value cases, etc. However, after reading the book by Clampitt and DeKoch as well as some other digital transformation literature, it became quite apparent that the idea of a linear and phased approach to the implementation of the analytics change initiative may be skewed and flawed. The following is an illustration derived from the recommendations of SAP in terms of value case resolution methodologies:

Value Case Resolution Methodology

[81] P. G. Clampitt and R. J. Dekoch, *Transforming Leaders into Progress Makers: Leadership for the 21st Century* (California: Sage Publishing Inc., 2011).

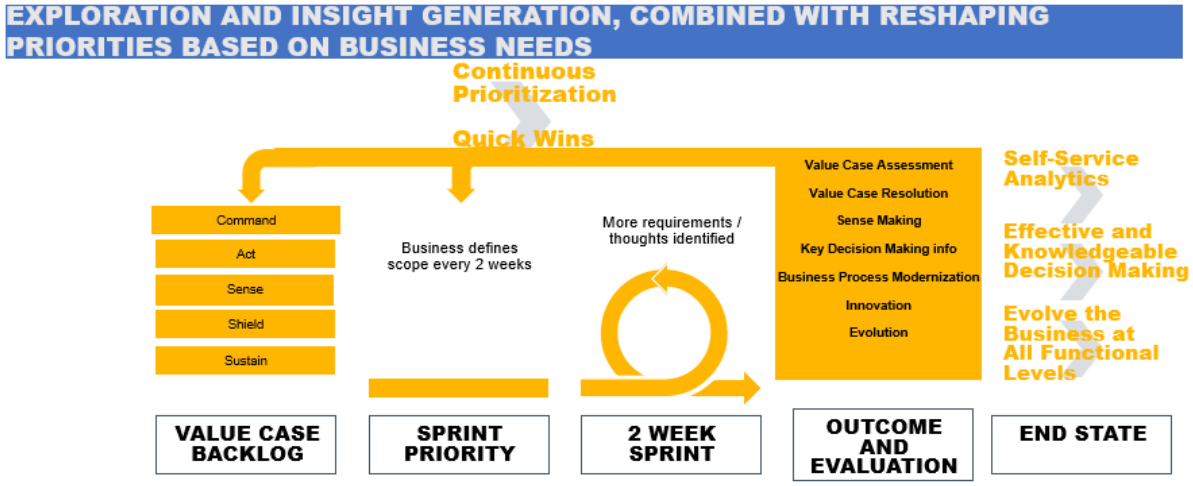



Figure 5.2[82]

The above figure demonstrates that a linear method is not required in this case. In some instance use cases that are resolved in one area, for example sustain, may lead to potential use case resolutions in another area such as Command. In an article by Eric Graham entitled "Success in Business 'and life' is Not a Linear Upward Climb he also suggests that successes do not have a linear straight path. He states that "success or upward progress often comes to us in big leaps, followed by plateaus."[83] In order to ensure that the above illustrated methodology be effective, perhaps a move away from a linear planning method to a more open and non-linear method would ensure the success in the development of a robust analytical platform that would be capable of managing the information from all operational functions. The best progress making strategy that would create value is to "cultivate a focused flexibility mind-set."[84] This strategy

[82] This illustration was derived from SAP's recommendations and methodology models for use case resolution.
[83] Eric Graham, "Success in Business (and Life) is Not a Linear Upward Climb," *Graham E.* (. http://ericgraham.org/success-in-business-and-life-is-not-a-linear-upward-climb/.
[84] (Clampitt and Dekoch 2011) p. 101

will be the key to the entire analytics journey. It emphasizes on the use of exploration which is the flexibility aspect and refining; the focus aspect. Clampitt and DeKoch suggest that "enduring progress can only occur if you do both."[85] The use of both focus and flexibility nicely fits with the non-linear approach to value case resolution. By allowing a flexible mindset with a stack of analytical value cases, we can then focus on obtaining small successes frequently. Essentially understanding data sets as it relates to business processes and discovering the value in those data sets will be the ongoing exploration. The focus will then be to chose and refine the digital transformation journey by picking the analytical value cases that can be resolved quickly. Essentially breaking the more complex value cases into smaller and manageable chucks. The focus-flexible mindset along with a non-linear approach, will provide deliberate selection of analytical value cases to resolve various business process issues. Just as analytics is being developed to uncover information at all functional levels, it would be important to build analytical data and reports that can track the progress made by the implementation of analytics in general. In other words, to what degree are we now faster, smarter and more efficient. Another concept that Clampitt and Dekoch suggest is the development of an exploration and refining. [86] The analytical platform would need to have the capability to explore and refine use cases as more information becomes available. When it comes to the exploration and refining of analytics, it would involve highly skilled individuals that are educated in the realms of data science. All of the tactics presented by Clampitt and DeKoch, support the strategy that is recommended by SAP. The methodology is in line with what is required to successfully implement data analytics. Tactics such as: short-term feedback loops, improving the peripheral vision and having less detailed planning, allows for the organization to be flexible and seize opportunities as they arise.

[85] (Clampitt and Dekoch 2011) p. 49
[86] (Clampitt and Dekoch 2011) p. 39

Choosing value cases that can be resolved in two to three-week sprints would generate those short-term feedback loops. These loops would generate a momentum of value and sensemaking throughout the organization. It would also assist in persuading interest awareness across the Improving peripheral vision would also manage meaning. Instead of being focused on resolving one particular value case, keeping an eye on other potential value cases that could be analytically resolved in the process would be paramount. Although a military thrives on detailed planning, having less detailed planning with regards to this change initiative will retain the flexibility mind-set. The flexibility mindset will create that exponential change within the organization.

## CHAPTER 6 - ISSUES WITH THE USE OF ANALYTICS IN ORGANIZATIONS

There are many issues with the use of analytics in organizations. In this section we will briefly discuss some of the major trending issues with regards to digital platforms and analytics. These problems are resistance to change, data and process transparency, data security and data quality.

New technologies and business process changes can always come with great resistance within an organization. Within CAF, people fear IT initiatives due to the fact that most often their implementation was painful and not done properly. According to an article published on the TechRepublic website, "out of 1,000 business decision makers, 98% agree the delivery of digital services and apps is critical to a successful company, but 95% encounter challenges when trying to do so."[87] Most recently the transition from the old Material Information System to the new Defence Resource Management Information System that began in 2009, is still having pain points throughout all CAF organizations today. When adopting a new technology, it will be important to show users that the analytics platform will create personal value as it will save them ample time creating certain reports and seeking decision-making information to do their job. A platform is a set of processes and procedures that create the avenue for sensemaking and implementation of a change initiative. One of the biggest issues that the article noted in the TechRepublic website on digital transformation is the complexity and the

[87] Macy Bayern, "The 5 Biggest Challenges to Digital Transformation and how to Overcome Them," *TechRepublic* (June 19, 2018). https://www.techrepublic.com/article/the-5-biggest-challenges-to-digital-transformation-and-how-to-overcome-them/.

lack understanding in terms of value across the organization.[88] Proper change management tactics will be discussed in greater detail later on in this paper.

Another issue surrounding business analytics is the increased visibility. Although that would seem like a good problem, it could cause greater anxiety among the work force knowing that processes and productivity is constantly measured. For example, if we go back to the discussion on the Procurement Section in Base Logistics on the East Coast, when exploring the reasons for the excessive workload in the buyer section, it was easy to see the productivity of each buyer within the section. Through data analytics, everything can become transparent down to the actions of the workforce per hour or minute. If not managed correctly this type of transparency could be detrimental to an organization.

Another major concern for the use of analytics in Defence is the security classification of different sets of information. In an interview reported on the McKinsey and Company's website as a transcript, the Vice President of E-bay stated that, "One of the biggest challenges is around data privacy and what is shared versus what is not shared."[89] This issue is even more prevalent in defence organizations. Depending on the platform or database, information may have different security classifications. For example, if we to go back to the Personnel value case as one of the pillars for FP&R, all the medical information would be Protected C and should not be easily accessible by the chain of command. However, there is filtered information that could be useful for example number of sick chits in the last month. The

[88] Macy Bayern, "The 5 Biggest Challenges to Digital Transformation and how to Overcome Them," *TechRepublic* (June 19, 2018). https://www.techrepublic.com/article/the-5-biggest-challenges-to-digital-transformation-and-how-to-overcome-them/.

[89] McKinsey and Company, "How Companies are using Big Data Analytics," (April, 2016). https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/McKinsey%20Digital/Our%20Insights/How%20companies%20are%20using%20big%20data%20and%20analytics/How%20companies%20are%20using%20big%20data%20and%20analytics.ashx.

reasons may remain Protected C but the statistic could be useful. Or perhaps there is a requirement to send a member immediately to an operational mission that would require certain inoculations. Without getting into a member's personal medical file, the system could provide a list of all members who have the specific inoculations along with other information such as training requirements and availability. If the analytical system could have a look at the specific information to provide the aggregated view without revealing pertinent information, then the information would be extremely valuable to the chain of command. Many of the analytical platforms have the capability of setting security parameters around databases and data sources. Based on user access authorizations, a view may not have the ability to see certain databases over the other. These platforms also have the capability of providing shadowed or delayed data for statistical purposes without revealing live or sensitive information.[90] To mitigate this concern, it would be important to consult with industry on all security related requirements.

The last issue we will discuss in this paper with regards to the implementation of a fully integrated analytical platform is data quality. In the interview transcript posted on the McKinsey and Company website, the Chief Risk Officer of American Express stated that, "The first change we had to make was just to make our data of higher quality"[91] Deriving analytical analysis from databases and data sources would only be as good as the data quality and accuracy that is being entered into the system. For example, when the CAF and in particular ADM Mat began to use the Business Objects suite to conduct analysis on the

[90] Information on security mechanisms in analytical platforms was given from discussions and visits with SAP.
[91] McKinsey and Company, "How Companies are using Big Data Analytics," (April, 2016). https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/McKinsey%20Digital/Our%20Insights/How%20companies%20are%20using%20big%20data%20and%20analytics/How%20companies%20are%20using%20big%20data%20and%20analytics.ashx.

information within the system, there were many inaccuracies identified in terms of data quality. Currently, the CAF supply chain management system does not have electronic bar-coding or radio frequency identification (RFID) coding for its items. The lack of this technology requires the manual entry of items into the system when items are being received or issued. This manual entry could result in the existence of human error. "The biggest challenge of making the evolution from a knowing culture to a learning culture—from a culture that largely depends on heuristics in decision making to a culture that is much more objective and data driven and embraces the power of data and technology—is really not the cost."[92] The CAF organization would have to become committed to ensuring that the data entering any database systems is as accurate as possible. However, this inaccuracy also provides and additional parameter. When an analytical report is produced it should always be read with a critical thinking mindset. Leaders and managers at all levels should always question and try to prove the analysis that is coming from the analytical system to ensure that the information is actually supporting the decision-making process.

[92] McKinsey and Company, "How Companies are using Big Data Analytics," (April, 2016). https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/McKinsey%20Digital/Our%20Insights/How%20companies%20are%20using%20big%20data%20and%20analytics/How%20companies%20are%20using%20big%20data%20and%20analytics.ashx.

# CHAPTER 7 - CHANGE MANAGEMENT

When it comes to the idea of digital transformation within an organization, one of the main issues is the organizational acceptance of new ways of doing business. As discussed in the previous section, when it comes to Information Technology and software advancements, it may be difficult to obtain organizational "buy-in." To move this change initiative forward D,L. Lewis in a book entitled, *Organizational Change: Creatinge Change Through Strategic Communication* suggests three activity tracks that incorporate the change process model: managing meaning, managing practice and managing networks.[93] Managing meaning relates to how both the implementers and stakeholders creates meaning in relation to the change initiative. In order to discuss what needs to be done institutionally and organizationally to ensure adoption of the use of analytics throughout the entire organization, we will break it down using Kotter's eight steps to leading change[94] and discuss what needs to be done while incorporating the activity tracks identified in D.L. Lewis' book. The following illustration is extracted from Kotter's website

Kotter's Eight Steps to Leading Change

[93] (Lewis 2011) p. 262

[94] John Kotter, "8 Steps Process for Leading Change," *Kotter* (2018). https://www.kotterinc.com/8-steps-process-for-leading-change/.


Figure 7.1[95]

For the purpose of this discussion we will modify these above eight steps into three easy and manageable steps: Remove Barriers, Create Early Users and Generate Early Wins and Often. These three manageable steps would be key to the full digital transformation of a Defence Organization with the ability to create self-service analytics that manage meaning, manage practice and manage networks at all leader and management levels.

**Remove Barriers**

As stated before, the initial adoption of a new business practice or IT platform can be difficult. The CAF is a large organization that comprises both civilian and military personnel.

[95] John Kotter, "8 Steps Process for Leading Change," *Kotter* (2018). https://www.kotterinc.com/8-steps-process-for-leading-change/.

The dynamics of these two workforces can often make change management initiatives problematic. Removing barriers is primarily an institution's responsibility. Essentially, removing barriers is the managing meaning activity track. This would involve the identification and involvement of all stakeholders throughout the process. The CAF should create a detailed campaign plan that explained the "what" and "why" and "how" with a tentative timeline. In an article entitle *Managing Change: One Step Forward, Two Steps Back* by Jeffery Nevenhoven, he outlines 7 key activities and organization can do to foster desire towards a change initiative. One of the activities suggests that regular communication of the meaning is required. He states that "re-communicating the 'what' and 'why' of the change initiative and allowing employees to develop ideas and methods on 'how' to achieve the desired outcomes."[96] Once the campaign plan is created, it would be imperative that the chain of command frequently communicate the implementation process of the new initiative and if possible, show the vision or even perhaps some successes that have already been achieved through the adoption of the new platform.

**Create Early Users**

There are many institutional factors in terms of personality, culture, and background that will have a huge impact on the success or failure of this particular digital transformation initiative. The culture within the CAF is extremely unique with two distinct work forces: the public servants and the military members. The military workforce can be ordered to adopt the change initiative, although with digital transformation an authoritative approach may not be conducive. The civilian workforce cannot be ordered to adopt the new method. In a book

[96] Jeffery S. Nevenhoven, "Managing Change: One Step Forward, Two Steps Back," *Industry Week* (March 15, 2016). http://www.industryweek.com/change-management/managing-change-one-step-forward-two-steps-back.

entitled *Digital Transformation: Build Your Organization's Future for the Innovation Age* it states: "the truth is that digital transformation is actually not about adapting to new technology at all – it is about directing an organization to be more adaptive to change itself."[97] Despite the existence of the chain of command, there are always key personnel within the organization that are essentially organizational leaders or influencers but do not necessarily have positional leadership or power. These key individuals often have worked in the organization for a long period of time and have the respect and trust of their supervisors, co-workers and subordinates. These individuals would be the best candidates as early users. When it comes to analytics, showing these key workforce leaders' early success and value of the new platform would create a positive momentum and help move the change initiative forward. Creating early users is incorporating the activity track of managing networks as well as managing practice. Early users with the appropriate organizational networks and influences can help champion the success of the change initiative to other members within the organization. It would be imperative to deliberately select key individuals across all sections of the organization that would deal with Command, Act, Sense, Shield and Sustain Operational Functions. The selection of these early users will be the key to create expansive endorsement fostering collaboration throughout the organization.

**Generate Early Wins and Often**

Creating early wins through the implementation process will drive the change initiative forward. Early wins help obtain organizational "buy-in." As some organizations start to

[97] Lindsay Herbert, "Digital Transformation: Build Your Organization's Future for the Innovation Age," Google Books, https://books.google.ca/books?id=UtY4DwAAQBAJ&printsec=frontcover&dq=digital+transformation+of+business&hl=en&sa=X&ved=0ahUKEwj538q1irDZAhUDjq0KHfCYBhgQ6AEIYDAJ#v=onepage&q=digital%20transformation%20of%20business&f=false (accessed 12 Dec, 2018).

experience the value of using the analytical platform, other organizations will want to experience the same. Fostering and environment with consistent and frequent success can help enforce the change initiative across all activity tracks. In particular, early wins will help manage meaning for the new change initiative throughout the entire organization. For example, when the RCN began to explore the use of the Business Objects suite, its successes quickly became known throughout the organization. When Defence Program Analytics stood up, many of the value cases that were resolved by the RCN within their own organization was revealed to other organizations throughout the CAF to help build excitement and "buy-in." Within a few years the Business Objects training was offered to leaders and managers throughout the CAF and small DPA teams were given the opportunity to visit other organizations such as CFRG and CANSOFCOM to assist with the digital transformation process within their own organizations. The journey towards the holistic analytics concept that involves all operational functions would involve the development of manageable value cases. Essentially, the implementation process must be broken down into smaller manageable segments. Generating early wins from simple value cases early and often will create the momentum for the overall success of the digital transformation change initiative.

Incorporating the activity tracks of management of meaning, networking and practice as well as the three key change initiative steps will be essential to the successful implementation of this change initiative. Digital transformation and change in a complex organization such the CAF will require non-linear unphased approach that adds value and makes sense to both the implementers and stakeholders. This non-linear approach should be communicated both in writing in the form of a campaign plan as well as frequent verbal messaging. This regular communication of the change initiative will ultimately add value to

the meaning and sensemaking throughout the organization. Creating early users will help strengthen the relationships between the implementers and stakeholders and ultimately provide the organizational endorsement towards the change initiative. It will be essential to manage the practice appropriately in terms of the development of the change management methods that will generate drive and positivity towards the change initiative. The CAF must work towards fostering a vision towards a fully integrated analytical platform that is capable of conducting analytics across all operational functions. This will enhance the intrinsic organizational values in relation to innovation and change. The CAF must continue to communicate the value of having a platform that will ultimately create efficiencies throughout the organization at all functional levels.

## CHAPTER 8 - CONCLUSION AND RECOMMENDATIONS

Digital transformation and data analytics for businesses and organizations is still a fairly new concept. Analytic technologies are advancing rapidly, uncovering the power to search, manipulate and extract information from both structured and unstructured data sources. Through the use of descriptive, predictive and prescriptive technologies, organizations can have a greater picture of their current state, potential future states and the outcomes of desired states. This allows greater fidelity and insight in terms of determining where and organization should go and how. Stronger and more robust technologies are being developed to enable analytical platforms in Defence organizations. Currently, the CAF is onboard with developing the Defence capability, however the current analytical platform presents multiple limitations. Given that the government expressed its desire to create a Defence Analytics Institute with an increase in spending of $2.3 million per year, it would be conducive for the CAF to explore analytical platforms that could integrate data across all operational functional domains. During the discussion within this paper there was a deeper look at two Sustain value cases that requires resolution, “The Journey” and the Effects of Sustainment in International Missions. The Journey aspires to create a modern employment model that could sustain and transcend generational gaps and differences. A robust analytical platform with the appropriate recruiting and onboarding software could provide great flexibility for the institution to manage military careers. This analytical platform would provide the CAF members a sense of autonomy and decision-making power over the direction of their own careers. Ultimately, through the exploration of the use of a robust analytical platform across all operational functions, the CAF could discover a stronger and more secure fighting force. A force that is truly capable of operating in any future environment with the

ability to adapt to emerging technologies. The other sustainment problem set was the issues surrounding sustainment effects in international mission. At this point it is difficult to determine the impact of operations one local economies. There are many layers within a local economy that could be stimulated through sustainment functions. These layers can include enemy force networks as well as black market and crime organization activities. When the CAF sustains itself in foreign missions, it should have more fidelity with regards to where it spends its money. Although there are some issues regarding digital transformation, the proper adoption of change management practices can ensure that analytics is embraced by the entire organization. They key to ensuring success in digital transformation is to ensure that the organization starts to improve its process quickly. Early wins, early adopters can ensure that the organization moves towards a flexible yet innovative mindset that is working to uncover bottlenecks and issues that if fixed, can transform the organization. Essentially, analytics will strive to remove the blindness that currently exists across all operational functions.

**Recommendations**

Based on all the information provided in this research project, the following recommendations are given:

a. Given that Defence Analytics topic is fairly new, there should be more research and exploration on the possible use cases and value cases that could be resolved within each operational function;
b. Explore all the use cases involved with all the four pillars of FP&R to inform the aggregated FP&R picture;

c. The CAF should continue to work with industry to explore the powerful platforms available for Defence Analytics including the development of intelligence platforms and common operating platforms for mission analytics;

d. The CAF should have a closer look at the current recruitment and retention model and explore the possibility of integrating a recruiting and onboarding analytical platform that could assist with the recruitment of the right individuals as well as uncover systemic issues for retention. Furthermore, the CAF should explore the onboarding model that would allow for a system matching of personnel to jobs based on pertinent information;

e. Should the CAF decide to implement a powerful analytical platform, it must develop the capability to observe and uncover sustainment effects on local areas of operation; and

f. The CAF should adopt change management best practices in order to ensure the successful implementation of a fully integrated and robust analytics platform through the use of three activity tracks, managing meaning, managing practices and managing networks.

## Bibliography

"ARCHIVED - Changes to CF Recruiting." 2001.*Government of Canada* (BG-01.007). http://www.forces.gc.ca/en/news/article.page?doc=changes-to-cf-recruiting/hnmx19p2.

"Canada Military Strength.", https://www.globalfirepower.com/country-military-strength-detail.asp?country_id=Canada.

. *RECRUITMENT & ONBOARDING TOOLS USAGE TRENDS REPORT | 2018-19*. 2019b.

Bayern, Macy. 2018. "The 5 Biggest Challenges to Digital Transformation and how to Overcome Them." *TechRepublic*. https://www.techrepublic.com/article/the-5-biggest-challenges-to-digital-transformation-and-how-to-overcome-them/.

Biswas, Sushman. 2018. "4 must-have Features in a Recruiting and Onboarding Software System
." *HR Technologist*. https://www.hrtechnologist.com/articles/recruitment-onboarding/4-musthave-features-in-a-recruiting-and-onboarding-software/.

Canadian Forces Recruit Group. 2016. *Tiger Team – Recruitment of Women in the Caf*. Ottawa:.

Clampitt, P. G. and R. J. Dekoch. 2011. *Transforming Leaders into Progress Makers: Leadership for the 21st Century*. California: Sage Publishing Inc.

Department of National Defence. 2010. *Canadian Forces Joint Publication*. B-Gj-005-300/Fp-001. CFJP 3.0 ed. Colonel R. Ken Chadder, OMM, CD.

Ducheine, Paul A. L., Michael N. Schmitt, and Frans P. B. Osinga. 2016. *Targeting: The Challenges of Modern Warfare*. Netherlands: Asser Press.

Foote, Keith D. 2018. "A Brief History of Analytics." *Dataveristy* (Data Topics). https://www.dataversity.net/brief-history-analytics/.

Graham, Eric. "Success in Business (and Life) is Not a Linear Upward Climb." *Graham E.* http://ericgraham.org/success-in-business-and-life-is-not-a-linear-upward-climb/.

Henschen, Doug. "16 Top Big Data Analytics Platforms.", last modified Jan 30, accessed Dec 15, 2018, https://www.informationweek.com/big-data/big-data-analytics/16-top-big-data-analyticsplatforms/d/d-id/1113609.

Herbert, Lindsay. "Digital Transformation: Build Your Organization's Future for the Innovation Age." Google Books, accessed 12 Dec, 2018, https://books.google.ca/books?id=UtY4DwAAQBAJ&printsec=frontcover&dq=digital+t

ransformation+of+business&hl=en&sa=X&ved=0ahUKEwj538q1irDZAhUDjq0KHfCYBhgQ6AEIYDAJ#v=onepage&q=digital%20transformation%20of%20business&f=false.

Houser, Nathan and Ted Johnson. 2017. "Data-Driven Deployments how Analytics can Transform Military Positioning." *Deloitte Development LLC*.

Isson, Jean Paul and Jesse S. Harriott. 2016. *People Analytics in the Era of Big Data*. New Jersey and Canada: John Wiley & Sons, Inc.

Keffer, Maj Gen Jim, Col David Hathaway, and Lt Col David Weissmiller. 2018. "The Cyber Edge: Unified Platform Unifies Cyber Warfighting." *Signal*. https://www.afcea.org/content/unified-platform-unifies-cyber-warfighting.

Kotter, John. 2018. "8 Steps Process for Leading Change." *Kotter*. https://www.kotterinc.com/8-steps-process-for-leading-change/.

Lewis, D. L. 2011. *Organizational Change: Creating Change through Strategic Communication*. Malden, MA: Wiley-Blackwell.

Lund, Susan, James Manyika, Scott Nyquist, Lenny Mendonca, and Sreenivas Ramaswany. 2013. "Game Changers: Five Opportunities for US Growth and Renewal." *McKinsey Global Institute*: 83. https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Americas/US%20game%20changers/MGI_Game_changers_US_growth_and_renewal_Full_report.ashx.

McKinsey and Company. 2016. "How Companies are using Big Data Analytics." . https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/McKinsey%20Digital/Our%20Insights/How%20companies%20are%20using%20big%20data%20and%20analytics/How%20companies%20are%20using%20big%20data%20and%20analytics.ashx.

Montiel-Sanchez, Ignacio. "Big Data Analytics for Defence.", accessed 03 Mar, 2019, https://www.eda.europa.eu/webzine/issue14/cover-story/big-data-analytics-for-defence.

Mooney, Liam. 2015. "The Difference between a Headhunter and Recruitment Consultant." . https://www.linkedin.com/pulse/difference-between-headhunter-recruitment-consultant-liam-mooney.

*The Gatekeepers.* Directed by Dror Moreh. Sony Pictures Classics, 2012.

Morgan, Blake. "Descriptive Analytics, Prescriptive Analytics and Predictive Analytics for Customer Experience.", last modified Feb 21, accessed Apr 14, 2019, https://www.forbes.com/sites/blakemorgan/2019/02/21/descriptive-analytics-prescriptive-analytics-and-predictive-analytics-for-customer-experience/#4dcf83b869e0.

National Defence. 2018. "National Defence Launches Investment Plan to Improve Openness, Accountability and Results in Defence Spending." *Government of Canada*. https://www.canada.ca/en/department-national-defence/news/2018/05/national-defence-launches-investment-plan-to-improve-openness-accountability-and-results-in-defence-spending.html.

———. . 2017. *Strong, Secure, Engaged: Canada's Defence Policy*.

Nevenhoven, Jeffery S. 2016. "Managing Change: One Step Forward, Two Steps Back." *Industry Week*. http://www.industryweek.com/change-management/managing-change-one-step-forward-two-steps-back.

Office of the Auditor General of Canada. 2016. "Report 5—Canadian Armed Forces Recruitment and Retention—National Defence." . http://www.oag-bvg.gc.ca/internet/English/parl_oag_201611_05_e_41834.html.

Otis, Nancy and Michelle Straver. 2008. *Review of Attrition and Retention Research for the Canadian Forces*: Defence R&D Canada - CORA.

Patel, Deep. "8 Ways Generation Z Will Differ from Millennials in the Workplace.", last modified 21 Sep, accessed 12 Nov, 2018.

SAP. "SAP Recruiting and Onboarding.", accessed 12 October, 2018, https://www.sap.com/canada/products/human-resources-hcm/recruiting-onboarding.html.

Smith, Adam, ed. 1776. *The Wealth of Nations*, edited by Edwin Cannan. New York: Modern Library 2000.

Smith, Jeremy. "History of Defence Logistics: Understanding the Value Today.", accessed Mar 14, 2019, https://www.koganpage.com/article/history-of-defence-logistics-understanding-its-value-today.

Stevenson, Mitchell, Karen Terrell, Mark Cramer, and Vijay Khatri. 2014. "How Analytics Improves Decision Making at the Department of Defense Finding New Ways to Add Value and Insights to Big Data." *Sas*. https://www.sas.com/content/dam/SAS/en_us/doc/conclusionpaper1/analytics-improve-decision-making-at-dod-107024.pdf.

Swanz, David. 2019. "Harnessing the Power of Behavioral Economics in Talent Acquisition." *HR Technologist* (Recruitment and Onboarding). https://www.hrtechnologist.com/articles/recruitment-onboarding/harnessing-the-power-of-behavioral-economics-in-talent-acquisition/.

Symon, Paul B. and Arzan Tarapore. 2015. "Defense Intelligence Analysis in the Age of Big Data." *Forum* (JFQ 79). https://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-79/jfq-79_4-11_Symon-Tarapore.pdf.

Taylor, Frederick Wilson. 1911. *The Principles of Scientific Managment* Harper and Brothers.

Textkernel, B. V. 2019. "Match!" *Textkernel*. https://www.textkernel.com/hr-software-modules/match-cv-to-jobs/.

Thomas, Jody. 2018. *House of Commons Standing Committee on Public Accounts: Canadian Armed Forces Recruitment and Retention Response*.

Thorne, Stephen J. 2017. "CAF Needs to be More Diverse, Says General." *Legion: Canada's Military History Magazine*. https://legionmagazine.com/en/2017/06/caf-needs-to-be-more-diverse-says-general/.

Vance, J. and J. Thomas. 2018. *Op Generation - CDS Directive*: National Defence.

Vanguard Staff. 2015. "DND Increase Pending, but Budget 2015 Delivers Industry Support." *Vanguard*. https://vanguardcanada.com/2015/04/28/dnd-increase-pending-but-budget-2015-delivers-industry-support/.

Weisman, Michael. 2018. "NATO, Partner Spec Ops Forces Rapidly Deploy for Trojan Footprint 18." *Air National Guard*. https://www.ang.af.mil/Media/Article-Display/Article/1548092/nato-partner-spec-ops-forces-rapidly-deploy-for-trojan-footprint-18/.