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PAPER

Leveraging Analytics to Drive Human Performance

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ABSTRACT

Recent audit reports by the Auditor General noted the potential impact to Canadian Armed Forces readiness due to sub optimal Defence Supply Chain performance. To identify the root cause of performance deficiencies and assess the adequacy of existing training, a systematic approach was employed to identify the knowledge and skills required by each Supply Chain role to perform their share of tasks across 39 Processes.

Based on the Department of National Defence Supply Administration Manual (SAM), the project team mapped Processes and Tasks to all applicable Supply Chain Phases. Processes and Tasks were also mapped to each role and the training priority was determined based on Difficulty, Importance and Frequency (DIF) analysis. We then mapped topics/teaching points from relevant course to existing processes and Tasks; and generated a list of processes and Tasks with "adequate", "limited" or "no" curriculum to support the acquisition of requisite knowledge and skills for each role.

The analysis revealed:

- All roles contribute heavily to the overall success of the Supply Chain in an integrated work environment – necessitating an understanding of the impact of their work on others.
- Developing curriculum incrementally over the years based on specific, sometimes narrow needs/performance and without a comprehensive map as outlined above yielded inefficient learning solutions.
- Developing role-based solutions in parallel with process-based curriculum resulted in gaps and duplication of effort.

This paper reaffirms the need for "*getting back to basics*". A thorough analysis and mapping of actual work/role requirements based on an authoritative reference, using a systematic process enabled by a leading-edge Training Management System, will provide a robust analysis framework. Training gaps and overlaps will become evident, and a blueprint for a comprehensive re-organization of the curriculum will naturally emerge.

KEYWORDS

training analysis, analytics, training effectiveness, training efficiency

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1 INTRODUCTION

The Supply Chain of the Department of National Defences is comprised of more than 600 million items. The items are globally dispersed across 300 government warehouses, covering 3.5 million square feet of space, and various private sector suppliers. The Supply Chain holds approximately $6 Billion of inventory such as ammunition and consumables; and $74 Billion in tangible capital assets such as repairable parts.

The Supply Chain performance shortfalls are well documented across the Department of National Defence. The Auditor General Audit Report 3 [5] highlighted the potential impacts of Supply Chain performance deficiency to Canadian Armed Forces operational readiness.

As part of a far-reaching strategic initiative aimed at addressing the People, Process and Technology deficiencies of the Supply Chain, a comprehensive Training Needs and Gap Analysis was undertaken to identify the knowledge and skill gap of Materiel Acquisition & Support practitioners. The methodology used to identify the needs and gaps, the main conclusions, and the recommendations as well as lessons learned are presented in this paper.

2 TRAINING NEEDS AND GAP ANALYSIS OBJECTIVES

The aim of the analysis is to identify the training requirements of Materiel Management Practitioners assigned to the Materiel Group and determine the adequacy of existing training programs. More specifically:

Compile a comprehensive list of enterprise level and subordinate tasks from authoritative references across the five phases of the materiel life cycle and Material Management roles.

Conduct Training Needs Analysis to select and prioritize tasks for the following four main materiel management roles: Supply Manager, Technical Authority, Control Officer, and Technical Inspector.

Curate existing performance support solutions and training material from various training centers to determine their adequacy as well as identify potential gaps.

Outline the findings, conclusions, and recommendations stemming from the analysis.

3 TRAINING NEEDS AND GAP ANALYSIS METHODOLOGY

A systematic approach in line with Aerospace and Defence Industries Association of Europe (ASD) [1], Canadian Forces Individual Training & Education System (CFITES) [2], Department of Defense Handbook [3], and Ministry of Defence [4] was used to identify the gap between practitioners' current knowledge and skills and those required to meet organizational goals or individual career aspirations. It unfolded as follows:

Step 1 – Task Analysis. Extract and map the Processes and subordinate Tasks to the applicable Supply Chain Phases, namely: Plan, Acquire, Warehouse, Support, and Divest. The info is extracted from the Supply Administrative Manual (SAM) and associated Materiel Acquisition & Support and uploaded to BNH Training Management System ADVISOR Enterprise™. In total, 39 Processes and 353 Tasks were identified.

Step 2 – Select and Prioritize Tasks for Training. Four distinct facilitated workshops with representatives from each of the four roles described above were conducted to capture and catalogue the Processes and Tasks performed by

each role. A Difficulty, Importance and Frequency (DIF) analysis was performed in the Training Management System for each selected Process, yielding a train/no train decision as well as a "low-medium-high" training priority for each selected task by role. The Difficulty, Importance and Frequency (DIF) analysis was conducted in line with the Canadian Forces Individual Training & Education System (CFITES) [2].

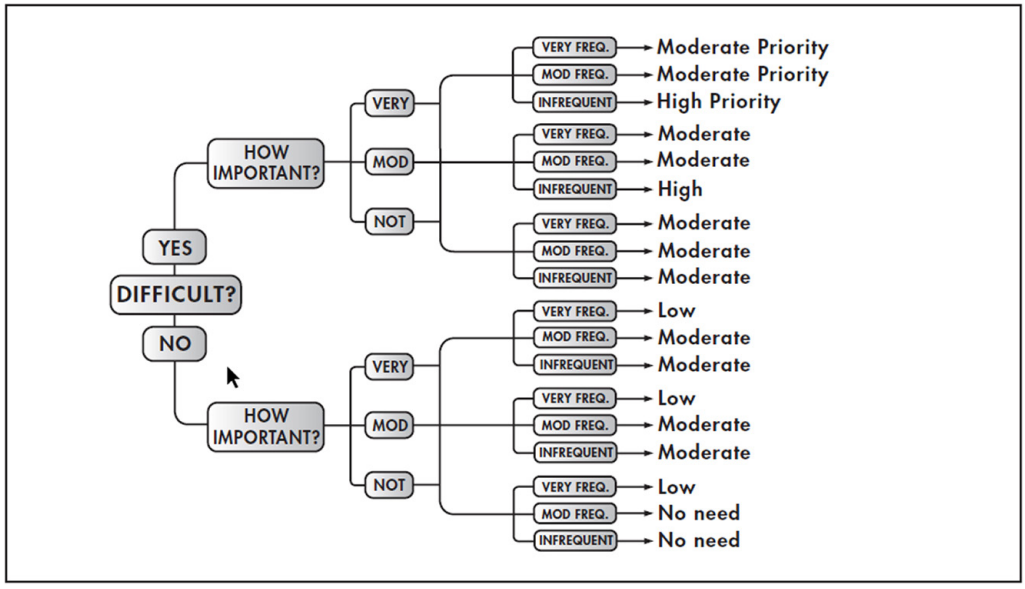

Fig. 1. CFITES detailed Difficulty, Importance and Frequency (DIF) analysis chart

A sample output from the DIF Analysis for Supply Managers is presented below.

Supply Manager

Phase	Enterprise Processes	Task Difficulty	Task Importance	Task Frequency	Task Training Requirement	Training Priority
Plan	Establish Account Structure	Low	Medium	High	Train	Low
	Establish Materiel Identification Requirements	Low	Medium	Medium	Train	Medium
	Forecast Materiel Requirements and Positioning	Medium	High	Low	Train	High
	Transfer centrally managed materiel between EPMs	High	Medium	Low	Train	High

Fig. 2. Sample output from Difficulty, Importance and Frequency (DIF) analysis

Step 3 – Determine Course Relevance. The Training Management System was then used to assess the relevance of each course by mapping their teaching points to the Processes and Tasks. Course modules, lesson details, including teaching points and duration, were extracted from existing course documentation, and systematically organized in the Training Management System. Teaching points were then mapped to existing Supply Chain Processes and Sub-Tasks based on their relevance.

Step 4 – Generate Fit/Gap Heat Map for Processes and Tasks. The analysis performed in Steps 1 to 3, was used to generate a list of Processes and Tasks which have "Adequate", "Limited" or "No" curriculum to support the acquisition of requisite knowledge and skills.

Step 5 – Generate Fit/Gap Heat Map for Each Role. Further analysis focused on the respective roles and training priorities as determined by the Difficulty, Importance and Frequency (DIF) analysis. A list of Processes and Tasks which have "adequate" (green), "limited" (yellow) or "no" (red) curriculum to support the acquisition of requisite knowledge and skills for each role is generated.

	Trg Priority																			
Enterprise Processes	DRMIS Supply Manager	DRMIS Stocktaking	Introduction to Life Cycle Materiel Management (LCMM)	Life Cycle Material Manager (LCMM)	Introduction to Integrated Logistics Support	DRMIS Materiel Identification Requester	DRMIS Records Control Officer	Distribution Resource Planning (DRP) Forecasting and Inventory Management for Supervisors	Distribution Resource Planning (DRP) for Life Cycle Material Manager	Distribution Resource Planning (DRP) Forecasting and Inventory Management for Planners	Basic Procurement & Contracting	DRMIS Materiel Management for 3rd Line R&O	Controlled Goods General Awareness Training	Packaging of Class 1 /Goods	Divestment of Centrally Managed Materiel	**Total (minutes)**		Materiel Managers: Supply Managers (SM)	Materiel Managers: Technical Authority	Materiel Managers: Records Control Officers (RCOs)	Materiel Managers: DQA Technical Inspector
Plan																				
Establish Account Structure	4	10														14		L		
Establish Materiel Authorization				36	1											37			M	L
Establish Materiel Identification Requirements	159		200	208		131	76									774		M	M	L	L
Forecast Materiel Requirements and Positioning	57		175					645	638	1279						2794		H	H		
Transfer Materiel Central to Local																			H	L	
Transfer locally managed materiel to TA/SM																			H	M	
Transfer centrally managed materiel between EPMs																		H	H	M	

Fig. 3. Sample output from Fit/Gap Heat Map

4 TRAINING NEEDS AND GAP ANALYSIS FINDINGS

4.1 Part 1: Task and role analysis

The number of tasks to perform across the Supply Chain can be perceived as overwhelming. For analysis purposes, they are summarized into 5 Phases, 39 Processes and 353 Tasks. The 39 Processes served as a foundational reference point and primary organizational construct for the task and gap analysis as they represent the totality of work across the Supply Chain and for each respective role. Figure 4 provides a summary of Processes and associated Tasks by Supply Chain Phase.

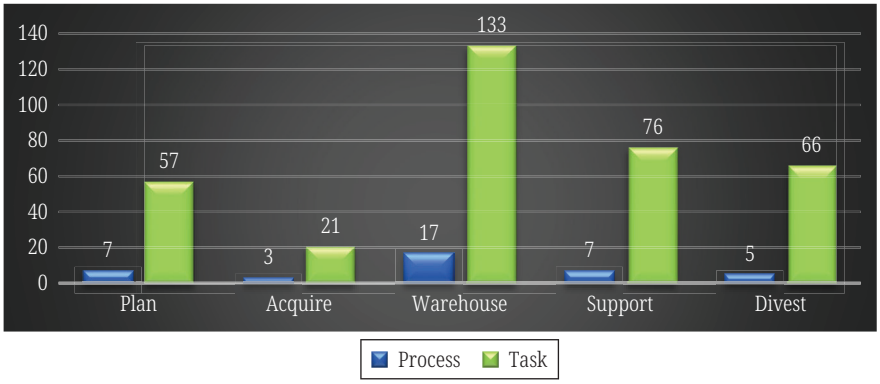

Fig. 4. Processes and Tasks by Supply Chain Phase

All analyzed roles contribute heavily to the overall success and performance of the Supply Chain. Three of the four roles (Supply Manager, Technical Authority, and Technical Inspector) are engaged across the 5 Supply Chain Phases and contribute to a wide range of Processes (16, 27 and 19 respectively). Control Officers have a more focussed role in the creation and maintenance of foundational data. They are engaged in only 2 Phases (Plan and Divest) and contribute to nine Processes.

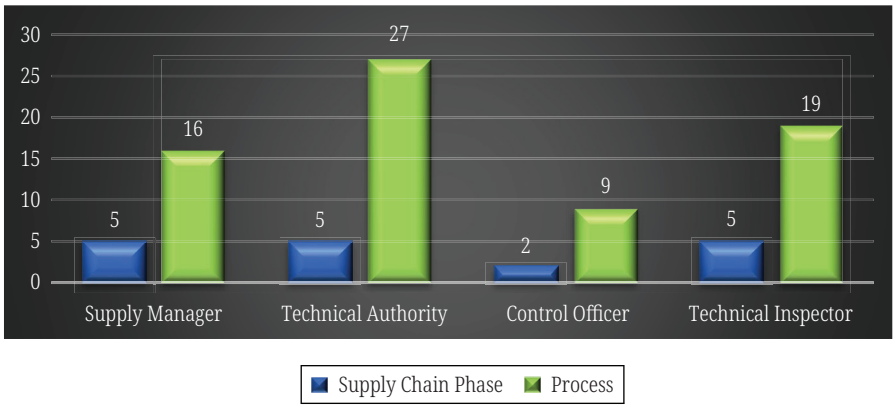

Fig. 5. Supply Chain Phase and process contribution by role

The next figure illustrates the highly integrated nature of the work performed by the four key Material Manager roles. As depicted below, several Processes are executed through the contribution of two or more roles across the Supply Chain life cycle. Ten Processes are performed through the contribution of two roles, eleven are performed through the contribution of three roles and two Processes require a contribution by the four roles.

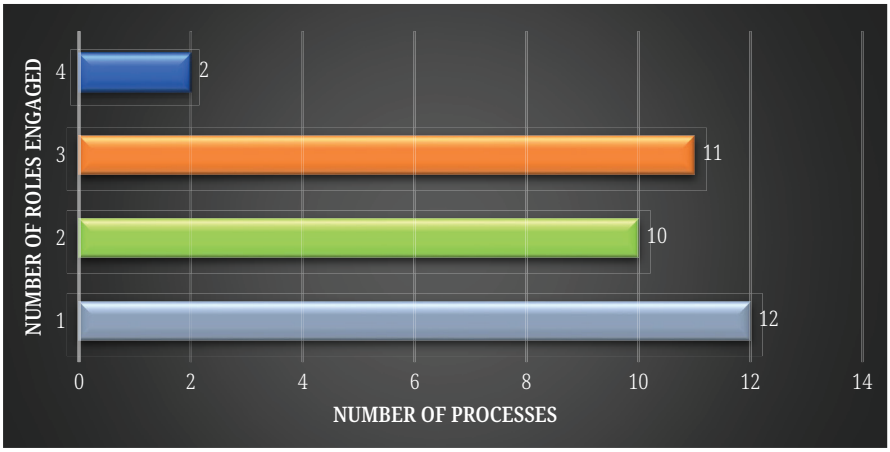

Fig. 6. Processes performed by one or more roles

Figures 4 to 6 above portray a work environment where practitioners are required to perform several tasks across multiple Processes and Supply Chain Phases in collaboration with one or more roles. Collectively, the four roles analyzed contribute to 90% of the applicable Supply Chain Processes (35 of 39), and more than half of the Processes (62%) are performed by two or more roles (24 of 39). This depicts an integrated work environment that requires specific activities to be routinely performed with the input of other roles and necessitates an acute understanding by practitioners of the upstream and downstream impacts of their work on other roles as well as overall effects on Supply Chain performance.

4.2 Part 2: Analysis of existing curriculum

Several courses across multiple training establishments and platforms were analyzed in terms of their relevancy in addressing the Supply Chain Processes and Tasks supported by each of the four roles. The specific fit/gap analysis findings for these respective courses are discussed in the next part of this paper, however, there are several issues related to the curriculum that are worth noting.

One legacy training intranet site hosts a repository of job aids and self-directed learning dating back to the roll-out of the first Supply Chain Enterprise Resource Planning in 2013 and in some cases even earlier. Overall, the user interface of the site is not aligned with established Supply Chain and taxonomy. Moreover, the navigation challenges to applicable performance support are compounded by multiple links to a number of resources such as the "Catalog", "Job Aids", "Self-directed Learning" and "Other Training Establishment" repositories. In addition to the doubtful currency of these "courses", some of the available material is no more than a series of MS PowerPoint presentations and links to job aids which is not considered on par with current training standards. For these reasons, courseware and performance support materiel contained in this legacy training intranet site was not included in the detailed Gap Analysis.

Conversely, curricula from the Materiel Management Training Centre pertaining to Supply Chain Processes and Roles is more current and better aligned with the taxonomy. There is also enhanced access to detailed curriculum information, such as learning objectives, teaching points and instructional time which allowed for a comprehensive analysis of courses. In total, this curriculum represents more than 200 hrs of instruction. The level of effort needed over the years to design and develop this training is significant. Using conservative industry metrics and assessing the complexity and level of interaction of this curriculum to low/medium, it can be surmised that a ratio of 150 hours of design/development for each hour of instruction is needed to produce this curriculum. This represents approximately 30,000 hours of total effort by Business Process Owners and the instructional design and development team. In addition, the maintenance efforts associated with this curriculum are considerable. Applying a 10% maintenance effort over a 5-year period adds an additional 15,000 hours of effort related to the sustainment of this courseware.

The curriculum was developed incrementally over the years, course by course, based on the specific, sometimes narrow needs/performance gaps perceived by individual business process owners. Such gaps are often identified following the release of new processes and/or technology, which required a learning solution for practitioners. As such, these courses are not designed based on, and aligned with, a comprehensive Supply Chain framework. Rather, these courses were typically designed in isolation, following a stand alone, narrowly focussed task analysis (if any) which yielded learning solutions that do not necessarily dovetail with other pieces of the Supply Chain curriculum puzzle.

Furthermore, over the years, role-based courses (such as Supply Manager, Technical Authority, and Control Officer) were developed in parallel with process-based curriculum such as Stocktaking, Distribution Resource Planning, Divestment of Centrally Managed Materiel etc. As such, duplication of effort and complexified maintenance challenges have emerged where similar content, can be found across multiple courses. Not only is this approach questionable in terms of efficiency, but it also introduces the potential for contradiction in the curriculum based on when the courseware is initially produced and last updated.

Additionally, some learning solutions (e.g. Introduction to Sustainment, Basic Intellectual Property) are not designed based on deliberate mapping to specific Processes, Tasks and Roles and therefore their relevancy to Material Management is difficult to assess. It is left to practitioners to determine where and how the principles and concepts discussed in the courses apply to their work.

Finally, although a Training Management System was acquired to systematically organize and document training requirements and associated curriculum, it must be noted that not all courses have an up-to-date Instructional Design Plan in the Training Management System which would contain essential information such as Performance/Learning Objectives, Teaching Points, Method, and Duration. Rather, analysts are often left to search in various repositories for instructor manuals, storyboards, student manuals to extrapolate the required data. This is in part due to some course creation pre-dating the Training Management System acquisition. The inconsistent availability of detailed curriculum data hampered the systematic mapping of teaching points to Processes and Tasks which made the relevancy analysis more challenging and findings less precise than originally anticipated.

4.3 Part 3: Fit/gap

In Instructional System Design, Fit/Gap Analysis is a process used to identify any gaps or discrepancies between what the curriculum currently addresses, and the established needs of practitioners as determined through a Task and Competency analysis. This section presents key findings focused on the relevance, adequacy, and comprehensiveness of the existing curriculum in addressing the Supply Chain Processes and Tasks.

Fifteen Instructor-Led and Web-Based Courses were analyzed to determine which learning objectives and associated teaching points could be linked to a Process and subordinate Tasks. Using a course centric approach (as opposed to a requirement centric approach), it is assessed that the courses were mostly relevant in terms of their association with Supply Chain Processes and Tasks. When analyzing the teaching points and their respective instructional duration, we are for the most part able to align those teaching points to the Processes and Tasks. Specifically, we found that 11 of 15 courses had high relevance, while 2 of the 15 courses were somewhat relevant and 2 courses had low relevance. Although this can be viewed as a good news story, it is only part of the narrative. As described below, although the current curriculum is aligned with existing requirements, there are many Processes and Tasks which are not covered. A summary of the relevance of the 15 courses is illustrated in Figure 7.

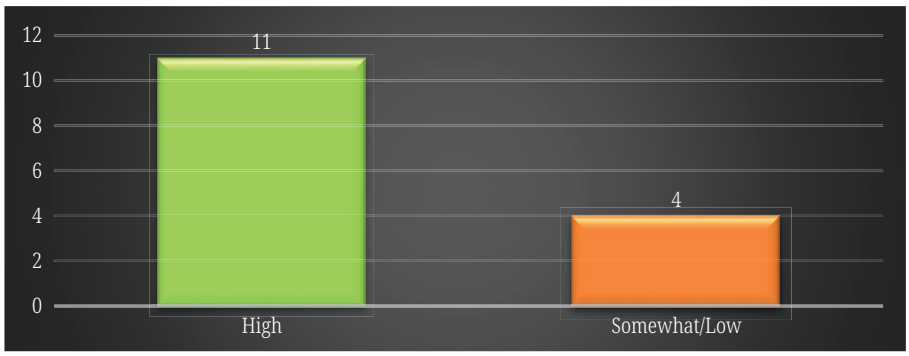

Fig. 7. Number of courses where existing teaching points are aligned with respective processes and tasks

When looking at the situation from a requirement's perspective, it is determined that our curriculum has significant gaps. When a Process and its subordinate Tasks had enough coverage in one or more courses, as evidenced by the duration of instructional time versus the training priority (High, Medium, Low), the coverage is assessed as "Adequate". When a Process and its subordinate Tasks had a minimal amount of instructional time in one or more courses, coverage is assessed as "Limited". If a Process and its subordinate Tasks had no coverage in any courses, the coverage is assessed as "No". Of note, 29 of 39 Supply Chain Processes have "Limited" or "No" coverage. The coverage for the 39 Processes across the entire Phase is presented in Figure 8.

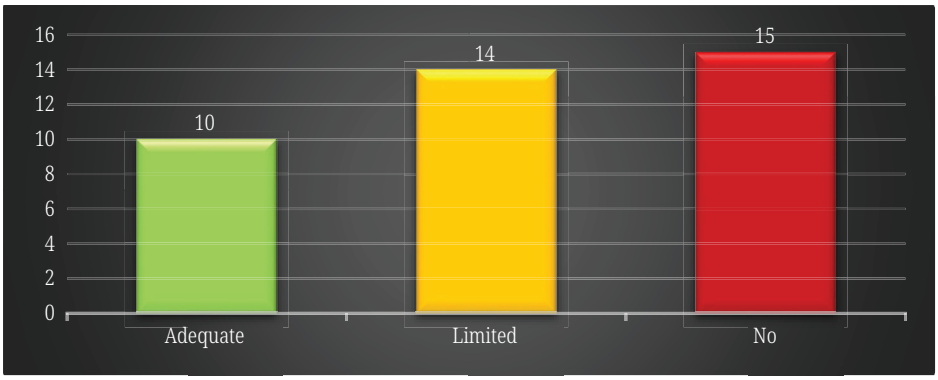

Fig. 8. Course coverage for processes and tasks across the Supply Chain lifecycle

Furthermore, the data highlighted a significant lack of coverage for the Plan, Support and Divest Phases which is problematic considering the roles analyzed are heavily involved in this aspect of the Supply Chain. It should be noted that several Processes with "No" coverage are part of the Warehousing phase and are therefore less critical given that Materiel Managers do not perform this work as a core function. In large part these tasks are performed by Materiel Custodians. A summary of Processes by Phases with "Adequate" courseware coverage is presented in Figure 9.

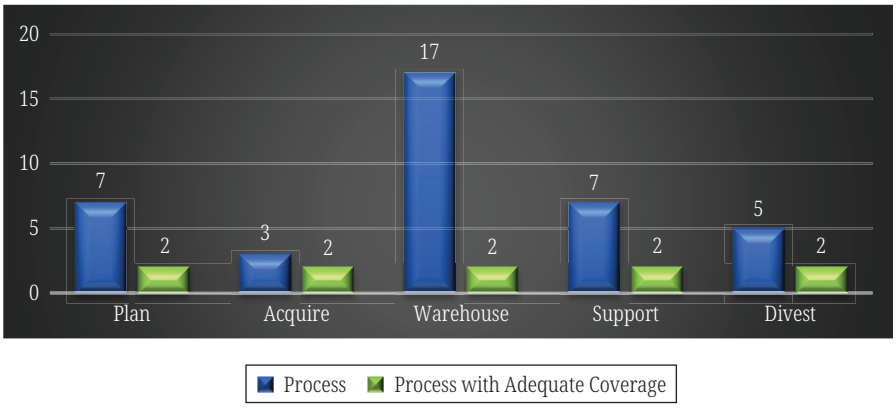

Fig. 9. "Adequate" courseware coverage by phase/process

Four workshops are conducted with representatives from each of the four roles. During these workshops, the team captured and catalogued the Processes and Tasks performed by each role in the Training Management System. Participants also performed a Difficulty, Importance and Frequency (DIF) analysis, yielding a "train/no train" decision as well as a "low-medium-high" training priority for each of the

selected Processes. A summary of the number of applicable Processes performed by each role is presented in Figure 10 along with the number of Processes which have been determined to have "Adequate" curriculum coverage. Furthermore, the data illustrated that curriculum coverage ranges from 56% for Supply Managers to 21% for Technical Inspectors. This represents a significant gap between available curriculum and the needs of practitioners.

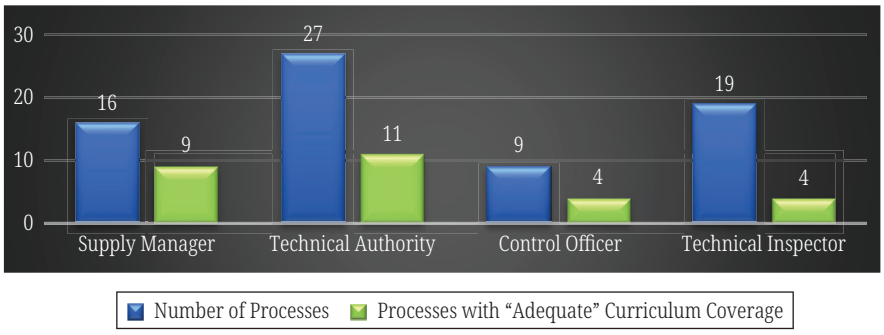

Fig. 10. Processes performed by Role vs Adequate coverage across curriculum

The curriculum is also comprised of series of role-based courses. Using the applicable Processes performed by respective role as identified during the workshops, a cross-reference analysis is completed to identify if the role-based courses provide "Adequate" curriculum coverage. The analysis revealed a severe lack of alignment between the training needs and priority of each role when compared to the role-based course content. Specifically, the Supply Manager workshop identified 16 Processes pertinent to their role, yet the Supply Manager course only addresses two of those 16 Processes. Similarly, the ratio is 27:2 for Technical Authority and 9:1 for Control Officer. A summary can be seen in Figure 11.

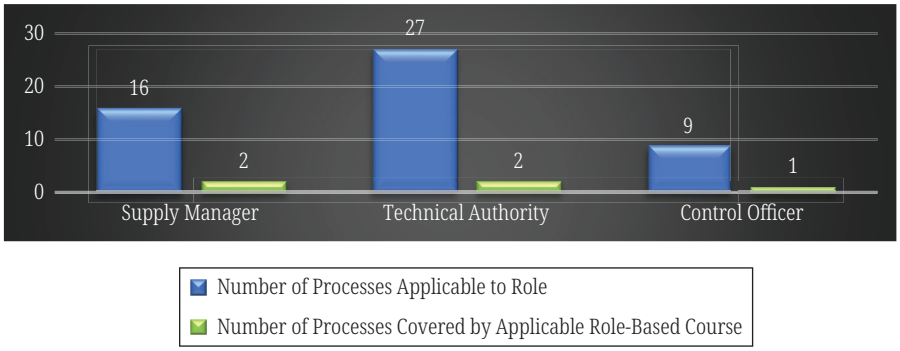

Fig. 11. Processes performed by Role vs Adequate coverage by role-based courses

5 TRAINING NEEDS AND GAP ANALYSIS RECOMMENDATIONS

5.1 Short term (next 12 months)

The current suite of courses can be delineated in two categories: role-based and process-based. Furthermore, individual courses have been developed over the years without a comprehensive set of end-to-end requirements for the entire business function. Based on our observations, this has led to a duplication of effort as well as inconsistencies in how the same topic is presented across the curriculum. This approach is not efficient in terms of courseware development and maintenance.

It was therefore recommended as a first step, to clearly articulate a shared vision for the long-term Material Management learning, training, and performance support blueprint and architecture. The architecture should seek to provide a framework that will address all enterprise, as well as specific role needs identified in the study describe herein. The modularized courseware must describe the facts, concepts, process, procedures, and principles inherent to each Process. Scenario-based courseware should consider and emphasize the roles played by various practitioners across each Phase and each Process. Furthermore, the architecture needs to provide an efficient framework for solutions to be produced once and packaged according to a minimum of two different types of needs. First, the courseware needs to be accessible by Supply Chain Phase and Processes, where a practitioner wanting to do a deep dive into the Planning phase for example, can register for one or more Planning Modules courseware. As well, the same modules should be assembled in qualification paths for each of our respective Roles. In that scenario, the Supply Manager role for example, would register for a qualification path that is comprised of 16 Modules (1 per applicable Process) across the five phases of the Supply Chain.

Course owners should also be guided in the validation of the specific findings as it pertains to their respective courses and establish a plan to address the most salient deficiencies. Short-term measures to mitigate the identified gaps could include the development of job-aids, course pre-requisites, readings, etc.

5.2 Medium term (subsequent 12–36 months)

Following the work performed to address the short-term recommendations, new steady state solutions will need to be developed to address the validated gaps. Existing courseware will have to be supplemented, and new solutions designed and developed to dovetail into the long-term Material Management learning, training and performance support solution blueprint and architecture.

The Material Management Training Center, working in collaboration with business process owner need to incrementally develop, modularized steady-state solutions to address validated gaps including Processes with limited or no course coverage as well as deficiencies identified in the role-based courses.

5.3 Long term (36 months and beyond)

Once the comprehensive list of solutions is developed to address the validated gaps for all Processes, the curriculum will still encompass role-based and Process centric courses which is not ideal. At this stage, the courseware and performance solutions could be fully modularized, and the role-based courses could be re-organized. The new role-based courses would be in effect be comprised of a foundational knowledge module coupled with a series of Process based modules applicable to their role. These Process based modules would be designed and developed once as apportioned to the various roles as determined in the Training Needs and Gap analysis.

6 LESSONS LEARNED

- Dated training material can reduce training effectiveness and efficiency. It can waste trainees valuable time on non-relevant and misleading information. Identifying and removing training material with minimal value is as important as identifying gaps.

- Learning solutions that are not designed based on deliberate mapping to specific operational requirement reduces training effectiveness and efficiency. Their relevancy would be difficult to assess and leave it up to practitioners to determine where and how the principles and concepts discussed in the courses apply to their work.
- Developing the curriculum incrementally over the years, course by course, following a standalone, narrowly focused task analysis or perceived needs by individual business process owners will yield learning solutions that do not necessarily dovetail with other pieces of the curriculum puzzle. A far better approach would be to design courses based on a comprehensive framework.
- Developing role-based courses in parallel with process-based curriculum will lead to duplication of effort, the introduction of similar content across multiple courses, and complex maintenance challenges. Not only is this approach questionable in terms of efficiency, but it also introduces the potential for contradiction in the curriculum based on when the courseware is initially produced and last updated.
- The use of relational database, enabled by the right user interface and workflow empowers instructional designers and subject matter experts to deconstruct training requirements and existing curriculum into organized and manageable chunks at the Knowledge, Skills, and Attitudes level. This enables precise needs and gap analysis and supports the display of data/findings in a granular but also aggregated manner, portrayed in terms of a clear articulation of the mission, processes, tasks, subordinate tasks, roles, etc. Fit and gap analysis is greatly facilitated. Moreover, Training Needs and Gap Analysis findings will be supported by implacable data and reports, and conclusions and recommendations emerge more easily.
- Maintaining Instructional Design Plans (including essential information such as Performance/Learning Objectives, Teaching Points, Method, and Duration) in a Training Management System is critical. As the mission and related tasks evolve, the Training Management System will ensure that relevant curriculum data is kept up to date. Inconsistent availability of up-to-date curriculum data can hamper the systematic mapping of teaching points to operational needs (tasks) and make the Training Needs and Gap Analysis more challenging and the findings less precise.
- Although the current study is focused on Defence Supply Chain, the findings are applicable to a wide range of domains. Namely, to preserve training effectiveness and efficiency, training should be continually realigned with operational requirements. For example, the effectiveness and efficiency of training on equipment/systems operation and maintenance can quickly decline if the training material is not updated as soon as the equipment/systems are upgraded. The same is true for any change that could impact training relevance. This includes changes to jobs, tasks, policies, environment, security, and so forth.

7 REFERENCES

[1] Aerospace and Defence Industries Association of Europe (ASD) Issue # 2.1, “International Specification for Training Analysis and Design,” 2022.

[2] Canadian Forces Individual Training & Education System (CFITES), Volume 3, “Analysis of Instructional Requirements,” 2003.

[3] Department of Defense Handbook (Part 2), “Instructional Systems Development/Systems Approach to Training and Education,” 2001.

[4] Ministry of Defence, Defence Direction and Guidance for Training and Education, Volume 2, "Individual Training," 2023.
[5] Office of the Auditor General (OAG) Audit – Report 3, "Supplying the Canadian Armed Forces (CAF)," 2020.

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