The Development of Methodology to Support Comprehensive Approach: TMC

Natalia Derbentseva
1133 Sheppard Ave. West
Toronto, ON M3K 2C9
CANADA

natalia.derbentseva@drdc-rddc.gc.ca

Michel Lizotte
2459 Boul. Pie XI Nord
Québec, QC G3J 1X5
CANADA

michel.lizotte@drdc-rddc.gc.ca

ABSTRACT

This paper reports the overall approach, development and validation of the Toolbox for Multidisciplinary Collaboration (TMC) methodology that has been developed at Defence Research and Development Canada. TMC consists of processes and tools designed to support interagency collaboration and the development of common understanding of a complex situation within a multidisciplinary civil-military team. TMC addresses such interagency challenges as mutual awareness of departmental goals and priorities and potential discrepancies between them; the development of the overall and common understanding of the operational environment; and interdepartmental collaboration. TMC aims to achieve this through a progressive application of its methodology components, each of which supports a different spectrum of multidisciplinary teamwork. The TMC development has been an iterative process and it heavily relied on the feedback from a group of inter-agency subject matter experts (SMEs) with operational experience. SMEs' feedback has been collected through interviews and workshops that exposed SMEs to the current versions of TMC and allowed for hands-on experience. Two case studies were conducted, in which small interagency groups conducted mission analysis based on a fictional Horn of Africa scenario. In the final case study the team applied TMC methodology in their work with positive results. The methodology development process and its components are discussed.

1.0 INTRODUCTION

The existence and condition of fragile states around the world defines global peace and security landscape. Security of western nations, including Canada, depends to a large extent on their ability to prevent state failure and to promote stabilization and recovery in the distressed regions. The contemporary stabilization efforts are complex and their sustainability requires a multi-dimensional approach to the troubled states that addresses various issues such as ethnics, religious, ideological and material; power and influence through diplomatic, economic and informational means as well as the national and international public opinion and Media. It became clear that stabilization efforts cannot succeed through the use of military power alone. Approaching such complexity in an effective way requires the capability of teaming people with different backgrounds in order to employ and align diplomatic, defence, development, and industry resources from numerous government and non-government agencies. As a result, the comprehensive approach (CA) to stabilization efforts that aims to

ensure a unified and coordinated effort of the different actors involved in the operation became an accepted norm in the international community (e.g., Patrick, and Brown, 2007) including Canada (B-GL-310-001/AF001, Godefroy & Gizewski, 2009).

Despite of all the benefits that the comprehensive approach promises to deliver however, there are many challenges that arise in the CA application and that inhibit the accomplishment of the desired outcomes. Some of these challenges result from differences at the departmental or organizational level of the players involved in the operations. These differences include differences in goals and mandates, operational styles, timeframes and work structure, oversight mechanisms, and organizational cultures, all of which are further exacerbated by a highly uncertain and constantly changing operational environment (Essens et al., 2013; Turnbull and Ulrich, 2013; Patrick and Brown, 2007).

While addressing some of these differences requires fundamental changes in how different government departments operate (rendering the feasibility of these changes almost impossible), other challenges can be mitigated to some extent through the CA process improvement. For example, the planning stage in the CA is very important in defining how the operations would unfold, how different departments will fit into the mission and their expected contribution to the mission achievement. If participating agencies collaboratively co-develop an integrated campaign plan, then such a plan would have a greater chance of coordinating multi-departmental efforts (Leslie et al. 2008).

Integrated planning team

In a pursuit of integrating and coordinating its efforts along the three lines of operations (LOO) in Afghanistan – security, governance and development – Canada implemented an integrated joint planning team, J5 team, at Task Force Kandahar in 2008-2010 (Turnbull and Ulrich, 2013). The J5 team was part of task force brigade headquarters, and it was responsible for a range of planning activities. The team was led by a chief planner, J5, at the Lieutenant-Colonel rank, and the team's composition changed depending on the strategic mission and operational requirements. The core of the planning team consisted of representatives for each of the LOOs coming from three departments – Department of National Defence (DND), former Department of Foreign Affairs and International Trade (DFAIT) and former Canadian International Development Agency[1] (CIDA). The extended team normally also includes an intelligence planner, J52, at the Major rank, and could include advisors on culture, policy, information operations, environmental operations, civil-military co-operation etc.

The integrated planning team required a common approach to planning in order to synchronise and coordinate its activities and team member contributions to the plans and to ensure collaboration. The team adopted the Canadian Armed Forces (CAF) Operational Planning Process (OPP, B-GJ-005-500/FP-000). The CAF OPP consists of five stages which require the team to analyse superiors' intent (both military and civilian), to conduct mission analysis, to develop mission statement, to develop and analyse Courses of Action (COA) that will achieve the mission, to conduct operational design and detailed plan of action, to issue warning orders to units involved and to review and evaluate the plan. See Figure 16-1 for an abbreviated summary of the process.

The team members, including civilians, were assigned to the planning team and worked together with the rest of the planning staff on the development of operational plans for the Canadian mission. The formation of such a team created an opportunity for the respective departments to provide their perspective on the planned operations at the outset and to contribute to the development of the plan. The planning team worked on resolving any potential conflicts in objectives and aligned them as much as it was possible.

[1] In 2013 DFAIT and CIDA were amalgamated into a single agency – Department of Foreign Affairs, Trade and Development (DFATD).

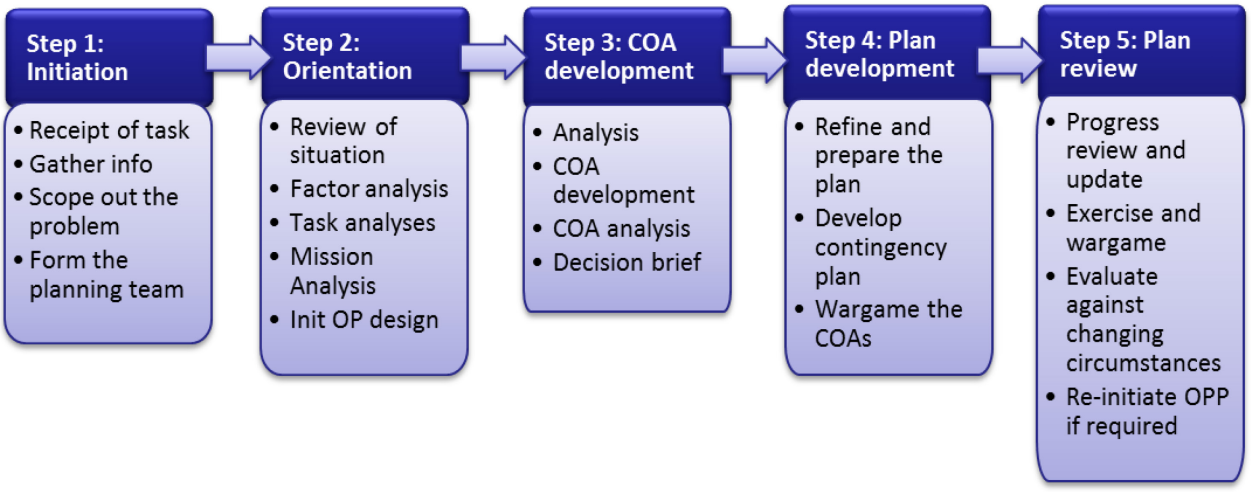

Figure 16-1: Five stages in the Canadian Armed Forces Operational Planning Process.

Although the integrated planning team facilitated better alignment and coordination of LOOs, the team encountered a number of issues in its operations that might have undermined some of its potential. Some of the issues the team encountered stemmed from the fundamental challenges of the CA and included: differences in organizational cultures of different departments, differences in planning approaches (including varying familiarity with the OPP – the adopted planning approach for the team – among civilians), differences in accepted internal communication practices and department-specific terminology, emphasis on different skills and processes for decision making, differences in desirable interpersonal skills and work structure (Turnbull and Ulrich, 2013). The team was co-located and relied on interpersonal interactions, which helped with understanding and resolving some of the departmental differences. However, the environment of guaranteed turnover with unsynchronised rotation cycles posed a new challenge of how to minimise the disruption in the team's workflow when team members change.

The implementation of the integrated planning team was an overall successful construct, and it is very likely that future Canadian stabilization efforts will implement similar multi-disciplinary and multi-departmental teams. There is an opportunity to find ways to mitigate some of the challenges that the integrated planning teams experienced in Kandahar and to facilitate their future operations. With this goal in mind, DRDC developed a methodology – Toolkit for Multidisciplinary Collaboration (TMC) – that aims to address some of the challenges that the planning team encountered. The ongoing development of the TMC methodology focuses on supporting the development of collaborative understanding of the operational environment within a multidisciplinary team to enhance its capability to design comprehensive solutions to complex multidimensional problems. The remainder of this paper describes the development of TMC (section 2), its main components (section 3), implementation recommendations (section 4), other potential application of TMC and its extension (section 5) followed by concluding remarks.

2.0 THE TMC DEVELOPMENT

TMC is an integrated methodology that consists of process and tool elements that support team dynamics, collaborative situation analysis, and knowledge representation and sharing. TMC methodology naturally evolved as an extension of a previous project on supporting sense making of complex situations (Lizotte, Bernier, Mokhtari, & Boivin, 2012). This project was part of the DRDC forward-looking Technology Investment Fund

(TIF) program that aims at exploring new ideas with high potential but high risks. The concept IMAGE developed in this project aimed at improving the collaboration of experts from different disciplines trying to reach a shared understanding of a complex situation. The goal of the concept was two-fold: increasing understanding of a complex situation and enabling individuals to share their comprehension.

IMAGE is a software toolset concept proposed to assist a team to gradually develop and test their individual or common model of a situation. Using IMAGE, team members can express their mental models of the situation (defining key elements and their interdependencies) into visual comprehension models that can be transformed into executable models. The latter are used to interactivity investigate possible situation evolutions through simulations. Visualization tools allow creating views bringing meaning to large datasets generated by numerous simulations. In laboratory experimental studies participants supported by IMAGE generally outperformed participants in the control group (Lizotte, Bernier, Mokhtari, & Boivin, 2012).

The current follow on effort originated from needs expressed by Canadian Army in May 2009 during which they stressed the importance of:

- Considering all perspectives of war (i.e. cultural political, economics …);
- Using analytical strategies e.g. filtering info and comparison tools;
- Increasing collaboration;
- Employing intuition and rational analysis in a complementary manner;
- Performing simple computer simulations for commanders and their key advisers;
- Forming a mental image of a combat/conflict situation; and
- Comprehending the likely outcomes of the dynamics governing the situation and the impact of decisions upon the situation.

The match between these needs and the IMAGE concept, in particular the IMAGE Representation module, was significant and it gave birth to the current effort. Further consultations with our military stakeholders identified and reinforced the multi-disciplinary J5 integrated planning team as a specific context for IMAGE application. Although the IMAGE Representation module had a good fit with the problem expressed by Canadian Army, the previous IMAGE validation efforts were laboratory studies and the IMAGE concept needed to be adapted to a real operational CAF context: the activities of a J5 integrated planning team. Rather than force-fitting IMAGE solution to this context, the research team approached the problem with a clean slate and undertook a careful study of collaboration challenges met by members of a J5 integrated planning team. In the course of this study the research team identified issues that could be addressed with the existing IMAGE functionality, but the study also revealed a number of issues that went beyond the current scope of IMAGE. As a result, the requirement to expand the scope of the project beyond the adaptation of IMAGE became evident, and the team embarked on the development of a Toolkit for Multidisciplinary Collaboration (TMC) with IMAGE as its central element.

The development of TMC has been an iterative process of development phases intertwined with frequent consultations with subject matter experts (SMEs) to solicit their feedback and guidance on the subsequent stages of methodology development. The SMEs who have contributed to the development of TMC are representatives of Canadian Forces and other government departments with operational experience in deployed integrated planning environment. The research team conducted informal consultations, formal interviews, a series of workshops, and two case studies all focusing on soliciting feedback from SMEs. This major undertaking helped to shape the current state of the TMC.

The study of the integrated planning team environment and its challenges began with a series of interviews with SMEs and a baseline case study. During the initial stage of the project, the research team interviewed 14 SMEs, five from the CAF and one DND civilian, four from former CIDA and four from former DFAIT. The interviews were conducted by phone individually with each SME and focussed on understanding the integrated planning team's main activities, different roles and responsibilities of its members, and identifying challenges that interviewees experienced in the integrated planning team environment. During the interviews, SMEs also provided recommendations on the support needs of an integrated planning team and on the design parameters of a planned simulation case study.

The next step in learning about the interagency planning environment for the research team was observing an integrated planning team in action. Numerous practical concerns made it impossible for the research team to observe operations of a real integrated planning team. Therefore, we designed and conducted a case study, in which two interagency groups conducted the first two phases of the OPP (initiation and mission analysis stages) based on a fictional Horn of Africa scenario. Each of the two teams in the base line case study consisted of four planners: two military planners, one development planner (civilian) and one governance planner (civilian). In each team, the military planner with the most planning experience was assigned the leading role (J5). The team was tasked with conducting mission analysis and preparing and delivering a mission analysis brief. No instructions were given to the teams and they went through the planning process in a manner that was based on their knowledge and experience. The case study was conducted under controlled conditions and allowed the research team not only to unobtrusively observe the teams through a video stream, but also to collect other data on teams' dynamics and performance.

From the consultations, interviews and the first case study we identified a list of 58 issues in the interagency planning context, which were grouped into 8 main categories. Table 16-1 lists the categories of issues with examples.

In our study, we also investigated the SMEs' perception of suitability of the military planning process, OPP, as a common planning approach in the comprehensive environment. The vast majority of both military and civilian SMEs found OPP to be quite appropriate and sufficiently detailed for the operations of an integrated planning team. Being quite flexible, the process can easily be adapted to the requirements of a situation and allows for integration of multiple perspectives. Main challenge with OPP for the civilians was learning the process and knowing when to contribute. The consensus was that the process worked well once they overcame this hurdle. As a result, we did not pursue proposing an alternative planning process to replace OPP in the comprehensive environment, but rather we set a precise target for the rest of the project on providing a joint integrated planning team applying the Canadian OPP with a collaboration support for understanding complex situations.

Analysing the collected information, the research team compiled a list of approaches to addressing some of these challenges. These were not yet specific solutions, i.e., specific tools or processes ready to use. Rather these approaches represented general methods for addressing the problems, and each of them could have different implementations. For example, OPP is a specific implementation of a planning process, which in our terminology would be an approach. The potential approaches that the research team generated came from three sources:

- Approaches envisioned by the team members (e.g., knowledge representation, supporting team building);
- Recommendations suggested by SMEs (e.g., an integrated product template, common glossary);
- Existing solutions that were used in other domains and that could be adapted to fit the specific requirements of the integrated planning team (e.g., cross-impact analysis, project and time management tools);

Table 16-1: Issues experienced by an integrated planning team identified through interviews and the case study.

Category of issues	Examples
Collaboration process	Team members are passive (do not show initiative), do not provide input; are dismissive, do not listen to or acknowledge others Stressed importance of informal interactions (smoking breaks)
Development of shared understanding	Disagreement on the key mission factors and their impact Teammate lacks understanding or provides unclear explanations
Integration of different perspectives	Lack of understanding of the opposite culture (i.e., civilians don't understand military and vice versa); Use of specialized vocabulary and acronyms Being focused only on his/her area; Different organizational priorities
Determining task focus and objectives	Lack of communication at the start led to uncertainty about the final product, confusion about the process and how to contribute and when
Problem and situation analysis	Missing critical information or skipping steps under time pressure Poor analysis of his/her area and Insufficient understanding of interrelations between factors
Task constraints	Interoperability of different systems Misinterpretations of the operational planning process Change of CIDA rep mid-way
Individual skills and experience	Teammates knowledge and experience was the most frequently mentioned factor (both helpful and unhelpful) Unable to summarize, organize and use provided information Poor analytic skills and Inability to deal with ambiguity
Final product format	The mission analysis template is useful but not adapted for collaborative work, humanitarian and political issues don't fit into the OPP template Frustrations with constraints imposed by PowerPoint and spending a lot of time on formatting

Overall, 33 potential approaches were identified. Implementing all of them in the context of a single project was not feasible, therefore the approaches were prioritised and a short list of approaches was selected for further consideration. In order to prioritise the potential approaches, each approach was assessed along 12 evaluation criteria that reflected the identified needs of an integrated planning team and the objectives and constraints of the current project. The criteria and the evaluation scale used to prioritise the approaches are reported in Appendix A. Eleven approaches with the highest score (one third of the original set) were selected for further consideration. These were:

1. Process/Tool to develop a shared model of the situation;
2. Shared situation awareness representation;
3. Product template/format co-designed by a multi-disciplinary team;
4. Problem framing process;
5. Solution framing process;

6. Kick-off procedure;
7. Brain-storming procedure promoting contribution /openness;
8. Common terminology tool/process;
9. Digital collaborative workspace;
10. Cross-impact method;
11. Comment capability to digital team outputs.

The list above represents a list of general methods, each of which can be operationalised in more than one way. For example, shared situational awareness representation could be implemented as a physical map overlay, as a conceptual diagram, or as a written document. The research team identified several most appropriate and feasible implementations of each of the short listed approaches and presented these to two groups of SMEs during a full-day workshop. During this workshop, the research team discussed each implementation with SMEs, after which SMEs selected a preferred implementation and provided feedback on its anticipated value and adoption feasibility within an integrated planning team.

The workshop results allowed us to narrow down the list of approaches for inclusion in TMC and to identify specific implementation for each of them for further development. In addition to providing feedback on the presented solutions, SMEs also identified the need for civilian OPP education to facilitate their integration into the planning activities, which was included in the list of considered solutions for TMC. Table 16-2 presents a mapping between the approaches and their selected implementations, also indicating those approaches that were dropped from consideration due to low perceived value and/or feasibility of adoption by an integrated planning team.

The selected implementations were developed and became components of TMC. These components were presented to SMEs during the next series of workshops, in which SMEs had an opportunity to interact with the specific tools and to see the results of their application. The toolkit components were further refined using the feedback obtained from these workshops. The final trial of the methodology took place during the second case study, in which an inter-agency team of SMEs applied TMC was during their mission analysis based on a scenario similar to that of the first case study. The overall reception of TMC was quite positive during that study, although more detailed results are still being analysed at the time of writing of this paper. The following section describes the methodology components and their organization.

Table 16-2: Mapping between TMC approaches and their selected implementations based on the SME feedback.

Approach	Selected implementation
Shared situation awareness representation;	Collaborative knowledge representation with IMAGE
Product template/format co-designed by a multi-disciplinary team;	Integrated mission analysis product template
Solution framing process;	Operational Design tool
Kick-off procedure;	Team building and handover procedure

Common terminology tool/process;	Interactive common glossary imbedded in IMAGE
Cross-impact method;	Cross-impact analysis method with an Excel template
(new) OPP reference material for civilians	Operational planning process (OPP) handbook for interagency planners
Process/Tool to develop a shared model of the situation	*Not considered further due to very low perceived value and/or feasibility of adoption by an integrated planning team*
Problem framing process;	
Brain-storming procedure promoting contribution /openness;	
Digital collaborative workspace;	
Comment capability to digital team outputs.	

3.0 TMC METHODOLOGY

Methodology components

The current version of TMC consists of seven components as outlined in Table 2, column "Selected implementation". Each component is described below.
The *OPP handbook for interagency planners* is designed primarily to familiarise civilian participants with the military OPP, thus improving their understanding of the overall process and expectations. In addition, it suggests a broader interagency perspective to military planners who are generally pretty familiar with a more exclusively military application of the OPP. This handbook, specifically developed for the DRDC project needs, borrows from the OPP Handbook developed by the Canadian Forces College (Canadian Forces College, 2005), although it has been extensively rewritten to incorporate a more interagency perspective.

The *Team building and handover procedure* is designed to build rapport and familiarity within the civil-military group, to set the team's expectations, goals and a roadmap for achieving them. The team building procedure is designed to help all the team members to clarify team goals, tasks, requirements, and the process to be followed by the team in achieving them. All of these are essential elements in ensuring effective operations of comprehensive teams (Essens, Febbraro, Thompson, Baranski, 2013).

The *Interactive common glossary* provides an easily accessible reference that can facilitate communication within the team and improve their shared awareness of each other's perspectives. (Essens et al., 2013, Turnbull & Ulrich, 2013). Experience with Canadian Whole-of-Government planning teams in Afghanistan clearly demonstrates that the development of a common understanding of terminology and concepts constitutes an important early step in building an effective team. This tool includes a glossary of interagency terminology and a

list of abbreviations. In addition, it is closely link with the Collaborative knowledge representation component enabling construction of comprehension models of the situation. The team members can use the vocabulary to build their models and conversely enhance their vocabulary from their models.

The *Collaborative knowledge representation* enables an individual to graphically externalise ideas in order to better understanding a problem and/or share thoughts with others. Such models of a situation can serve as a good catalyst for team discussions. A comprehension model is composed of a set of Conceptual Diagrams and a set of vocabulary modules defining the relevant terminology to represent the problem at hand. To help finding similarities and links between different perspectives, this component also allows to identify diagrams matching a graph pattern and to unify a set of diagrams into a single one. This TMC component was designed from the Concept Maps approach (Novak ,1998) and the Conceptual Graphs theory (Sowa, 1984; Chein & Mugnier, 2009).

The C*ross-impact analysis method* is an analytic technique that encourages the team to engage in an in-depth collaborative problem analysis. This method focuses on identifying key factors and analysing their interdependencies. It is a simplified cross-impact analysis increasing awareness of critical interactions. First, elements for analysis are identified. They are then mapped against each other to determine their mutual influence. Finally, possible interventions are defined and their impacts are assessed.

The *Operational design tool* supports the planners in their brainstorming to sequence decisive points into lines of operations and to identify operational phases with their associated objectives and tasks. It provides the grounds to initiate the thinking required to identify possible branch plans and/or sequel plans where transition conditions are desired (Bélanger, Guitouni & Pageau, 2009)

The *Integrated mission analysis product template* ensures that the product format is responsive to output demands of different participating agencies.

TMC areas of support

The main overarching focus of TMS is to support collaborative sensemaking, which was conceptualized in delivering support in three main areas:

- Development of common understanding within the team;
- Integration of different perspectives in teams sensemaking and products;
- Supporting collaboration processes within the team.

These three support areas are not mutually exclusive and success in one area depends on the other two. However, each of them possesses unique qualities and ensuring one may or may not imply the achievement of either of the remaining two. For example, an effective collaboration can be achieved within the team through disambiguating and ensuring communication, but this does not guarantee the development of common understanding or integration of different perspectives. All three of the above aspects of teamwork need to be attended to for a coordinated and unified multi-disciplinary team effort.

Figure 16-2 illustrates how different TMC components contribute to the three focus areas of support, namely development of common understanding, integration of different perspectives, and supporting collaboration processes. Four of the seven methodology components – knowledge representation, common glossary, cross-impact analysis, and OP Design tool - contribute to all three main areas of support more or less equally. OPP handbook, being mostly a reference material, supports collaboration and development of common understanding

to a greater extent than integration of different perspectives. The team building and handover procedure mostly focuses on supporting collaboration. MA briefing template facilitates integration of perspectives and collaboration to a greater extent than development of common understanding.

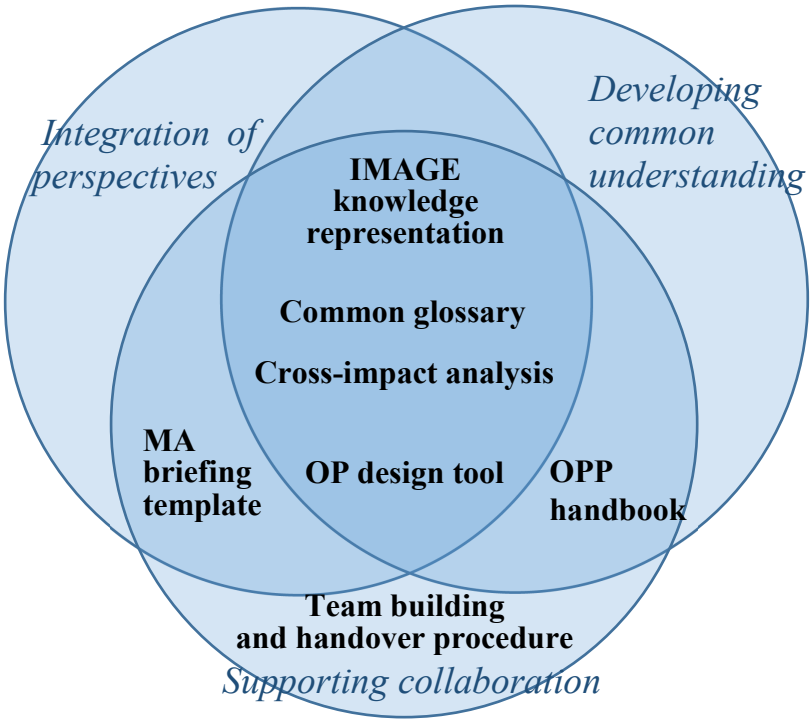

Figure 16-2: Distribution of TMC components among the three support areas.

TMC organization

From the discussions with SMEs it became evident that the best way to organize the methodology components was through a modular structure, or a toolbox approach, as opposed to implementing them as functions in a single multi-functional support system. SMEs pointed out that the situations that an integrated planning team faces are quite diverse and have different requirements and constraints, which also change the support needs of the team. While a specific functionality can be helpful in one situation, the same functionality could be impractical in another situation. The advantage of the toolbox approach is that it allows for putting together a collection of relatively simple and independent tools that can be picked on a need basis. The ability to pick and choose combinations of tools that match the requirements of the task is more desirable in a changing environment of an integrated planning team than a single generic complex support system. Therefore, TMC was developed as a toolbox of independent components, each of which could be used independently from the rest or in combination with other components.

Although the TMC components can be applied independently from one another, they also could be used in a complementary fashion. Their application lends itself on a natural sequence that allows building comprehension of the situation within the team gradually. Figure 16-3 and Figure 16-4 respectively position the components in stages Initiation and Orientation of the OPP.

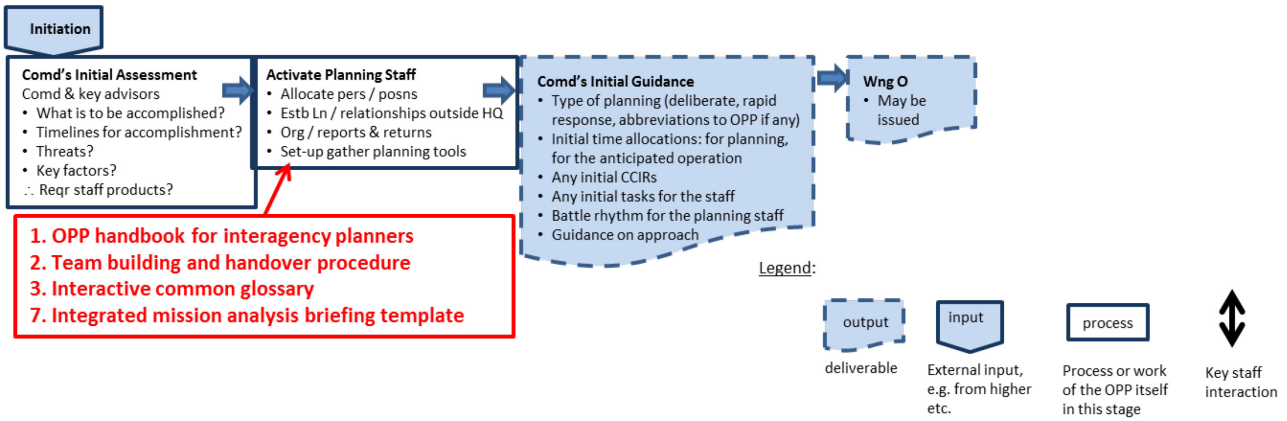

Figure 16-3: TMC and OPP Stage One: Initiation.

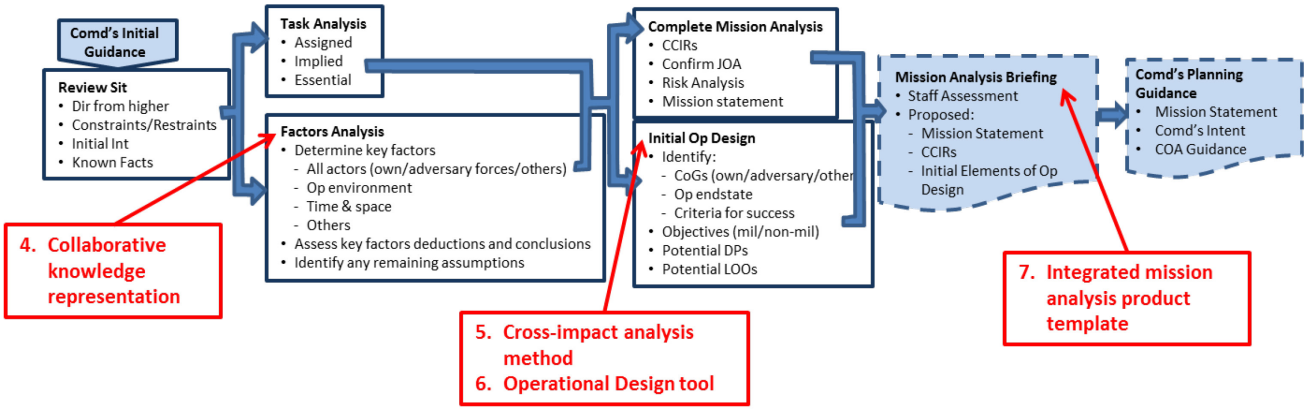

Figure 16-4: TMC and OPP Stage Two: Orientation.

Some of the components provide strongest support to the team at the beginning of the planning cycle, e.g., the team building procedure and the OPP handbook. The MA briefing template is useful at the beginning of the planning cycle, because it sets expectations for deliverables and the format of the team's product. The common glossary component supports the team throughout both stages of the planning cycle helping the team members to disambiguate their language and arrive at common terminology. TMC components that support situational analysis – the knowledge representation component, the cross-impact method and the OP Design tool – are more applicable during the second phase of OPP, mission analysis, and, if all three are used, they are best applied in that sequence.

To ease the transition between components, TMC offers interoperability between some of them as illustrated in Figure 16-5 with dashed directional lines between component boxes. Dashed lines imply that the input/output information exchange between components is optional, and that each component can be used as a standalone tool. Most of the information exchange capabilities were built between the three situation analysis components, which allow exporting the results of the analysis into the final product – the MA briefing template. The common glossary component provides a background support for the analysis through the knowledge representation capability. The OPP handbook and the team building procedure contribute to the development of common glossary.

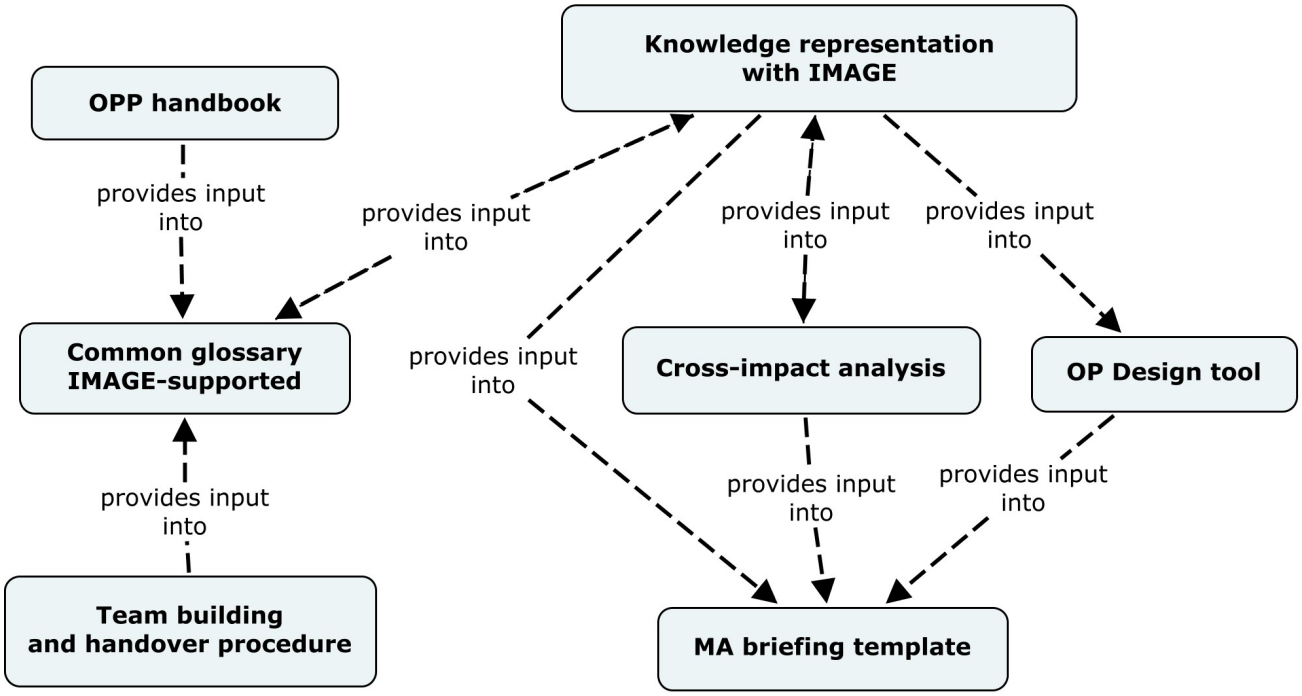

Figure 16-5: Interoperability between TMC components.

Figure 16-5 also illustrates that the knowledge representation component is the central element in the TMC methodology that ties together different components through the information exchange. The knowledge representation capability is at the heart of the TMC methodology also because it provides the means for the team to develop and share their common picture of the situation and as a result, it facilitates discussion and collaborative sensemaking.

4.0 TMC IMPLEMENTATION RECCOMMENDATIONS

The TMC methodology was developed through iterative consultations and trials with SMEs, culminating in the final case study that required a civil-military multi-agency group of SMEs to apply the methodology while conducting mission analysis. Although the final case study results are not completely analyzed yet, we would like to discuss several recommendations for TMC implementation.

Firstly, we believe that the application of TMC should begin before an integrated planning team deploys. Some TMC components, such as knowledge representation, cross-impact matrices and glossary may require preliminary development or sufficient time for their development during the mission in order to take advantage of their full range of capabilities. While this time investment may not be justified for a short time sensitive mission, the development investment will be well justified for longer missions. Therefore, usage of many TMC components would ideally start during the pre-deployment training. This would allow the team to build its knowledge base, e.g., conceptual diagrams, vocabulary modules, cross-impact matrices and OP Design charts.

Secondly, a TMC tool “expert” should be part of the team during the pre-deployment training and during the deployment itself, or at least be easily available to assist users as needed.

Thirdly, in the course of the TMC development and our interactions with military SMEs, we derived several recommendations with respect to the OPP guide and training:

- There is a need to make an explicit emphasis on the importance of team building and the development of appropriate team dynamics within the planning team from the very outset. Currently, there are no systematic recommendations in the OPP guide on how to achieve that, especially in a multi-agency context. We propose to include instruction on the team building and handover procedure in the OPP training for military leaders.
- There is a need to emphasise problem analysis during the orientation and course of action development stages of the OPP. According to SMEs, many planning efforts shortcut the problem analysis phase and jump into solution development from early on. TMC methodology includes tools that provide support for situation analysis, e.g., knowledge representation and vocabulary management with IMAGE, cross-impact method, and OP Design tool. We propose to include instruction on these TMC components as part of the OPP training.
- Military planners more often work alongside civilians. For this reason it would be beneficial for military planners to be familiar with planning approaches used by their civilian counterparts. The Treasury Board of Canada approved the Results-based Management (RBM) planning process for the Government of Canada. Therefore, we propose that in addition to the OPP handbook, a complementary RBM handbook should be provided to military planners. The RBM handbook would describe the civilian planning process in relation to OPP.

Education about TMC and its capabilities is best to begin in the context of OPP training for the military planners, even before these planners are assigned to integrated planning teams. This will facilitate military personnel's understanding and appreciation of TMC functionality and appropriate settings for its application.

5.0 POTENTIAL EXTENSION OF TMC AND ITS OTHER APPLICATIONS

As mentioned above, the current effort originates from the intersection of the concept IMAGE and the needs expressed by Canadian Army in May 2009. Because it was not possible to address all of these needs in the context of a single S&T project, it was decided to focus the TMC methodology development on the J5 integrated planning team environment. The appreciation of TMC by SMEs and their comments during the workshops, and particularly during the last case study, demonstrated that it was a good decision. SMEs also confirmed that some of the TMC components and some of the solutions that were considered for inclusion in TMC, but not implemented (such as "what-if simulation") could also have a very good fit in other settings.

A What-if simulation tool was one of the implementations considered for the Shared model development approach. It was not included in the final version of TMC, because SMEs judged it to be time-consuming and not worthwhile for a short-term setting such as the one selected for TMC development. The idea for the What-if simulation component was to use simple simulations resulting from executable models derived from knowledge representation models. The What-if simulation approach consists in elaborating hypotheses on a system's "behavior" and observing if results sustain or disprove the hypotheses. Simulation adds rigour and helps supporting shared understanding. Results of a simulation encourage such questions as "Do results confirm the shared understanding? For everyone? If there is a discrepancy between the results and the shared understanding, is the model wrong?" Even if the results prove to be erroneous, the inquiry process itself would still be useful as it encourages further examination of the problem. SMEs recognized the potential of What-if simulation for longer-term activities that start before specific deployments. If TMC is to be applied in such contexts, a What-if simulation component should be added to the toolbox. Given the modular structure of TMC, it will not be difficult to expand TMC's collection of tools.

Similar to the What-if simulation component, some other components that were included in TMC also have a good fit in a longer-term setting. For example, collaborative knowledge representation, cross-impact analysis and interactive common glossary components would serve well such settings that require following the evolution of situations and continuous update of their comprehension. A more specific domain is intelligence for which the core of the effort is about maintaining a good comprehension of the threat. SMEs with intelligence background who participated in our study currently explore the application of some of the TMC components to intelligence work.

Although TMC was developed with a specific application area in mind, i.e., the integrated planning team, its application is not limited to the J5 environment. The methodology, having a broader emphasis on supporting collaborative sensemaking, can be applied in a variety of settings that involve a team of experts jointly working on a problem. As we pointed out above, intelligence is one potential area for TMC application. Cyber security domain is another. Cyber security work is a complex challenge and DRDC is investigating the applicability of some of the TMC components in this context. Risk analysis in the cyber security domain involves identifying critical components, investigating attack vectors and study impacts of successful attacks. Such analysis requires an efficient collaboration between a number of experts, e.g., experts on friendly missions, enemy intents, computer networks and software applications.

6.0 CONCLUDING REMARKS

CAF recognises the importance of a comprehensive approach considering all dimensions of a situation, more than the military power alone. The various issues (ethnics, religious, ideological and material), the various power and influence (diplomatic, economic, informational ...) as well as the national and international public opinion and Medias are examples of the variety and diversity of the dimensions that contemporary stabilization efforts face. A whole-of-government approach is required to achieve the strategic national objectives on these missions, a process that needs to begin with a comprehensive approach to elaborate plans.

The comprehensive mission planning is an important process in current operations. Problems that are missed or not addressed during this process become magnified during the implementation phase and could lead to undesirable consequences. In order to facilitate comprehensive mission planning, Canada implemented an integrated planning team to ensure that all perspectives are taken into account from the early on in mission development. DRDC developed a methodology that provides collaborative sensemaking support to such planning teams and facilitates some of the issues in the civilian-military collaborative planning process.

The methodology consists of a collection of relatively simple and independent components that support team processes, situation and problem analysis, and team products. It is worth noting that the TMC methodology is a prototype and it needs further development before it is fully operational. The focus of the project was to develop and demonstrate the concept of such methodology.

Despite positive feedback from SMEs during the final case study, the final implementation of the methodology in the operational context depends on many factors. The implementation of the methodology will require developing training for the end-users, ensuring compatibility of the components with various civilian government and military networks and allocating dedicated technical support. As such, in addition to the end-user support that we obtained through our SMEs, further development and implementation of the methodology will also require additional resources and support from senior management across different agencies.

The TMC methodology aims to facilitate a certain set of issues that arise in a comprehensive mission planning. It is worth noting, however that TMC did not aim, and therefore cannot address all the problems in a comprehensive mission planning context, and more work is needed in this area. We believe that concepts implemented in TMC, such as emphasis on group dynamics and problem analysis can have a positive contribution to the overall OPP training of Canadian military planners.

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APPENDIX A: CRITERIA USED TO PRIORITISE POTENTIAL APPROACHES FOR INCLUSION IN THE TMC

The first level of approach prioritization was based on a set of four mandatory criteria each of which had to be met for an approach to be considered for further development. These mandatory criteria were:

- Being within the scope of 12om.
- Feasibility to implement this tool/process within 12om human resources.
- Feasibility to implement this tool/process within 12om financial resources.
- Feasibility to implement this tool/process for the final case study at the end of the project.

Approaches that past the mandatory requirements test were evaluated along each of the following eight criteria that were derived from the identified needs of the planning team and the project objectives using the scale ranging from 1 – very low to 5 – very high:

Primary impact criteria:

- Anticipated improvement of shared understanding
- Anticipated improvement of integration of different perspectives
- Anticipated improvement of collaboration processes

Secondary impact criteria:

- Anticipated improvement in ability to define task focus and objectives
- Anticipated improvement in ability to mitigate task constraints
- Anticipated improvement in ability to perform problem and situation analysis

Tertiary impact criteria:

- Anticipated improvement of individual skills
- Anticipated improvement of final product format

Each research team member performed the evaluation individually, the results were averaged, and approaches that received the highest overall score were selected.