A DL Course in Risk-based Decision-Making for Marine Safety and Environmental Protection Professionals in the United States Coast Guard

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Abstract

This paper explains the motivation for a proposed course design for marine safety and environmental protection professionals in the United States Coast Guard (CG). The course is intended to build competency in risk-based decision-making under a distance learning (DL), continuing education format. The course design is, first and foremost, contextual by working from prototypical representations of the decision-making problems that are encountered within the CG's Marine Safety Offices. From these representations the concepts, methodology and tools for effective risk-based decision-making are introduced. The result is an integration of material from decision/risk analysis, information technology and stakeholder negotiations. (*The views presented in this paper are those of the authors and do not necessarily reflect the official view of the United States Coast Guard.)*

1. Introduction

The C.G. is charged with the stewardship of marine safety and marine environmental protection for the United States. Although the nation's marine transportation system operates at a level of safety unparalleled in history, and though environmental protections have never been stronger, the need to operate securely and to have a clean environment grows stronger daily. The possibility of a major accident or pollution incident is increasingly unacceptable, as both the public and its government representatives become less tolerant of risk.

Concurrently, the CG has been required to meet its responsibilities with progressively fewer resources. In response to the call for "doing more with less" the CG has identified the improvement of field level decision making processes as a major strategic objective. Specifically, CG Headquarters has encouraged district and field level commanders to implement more cost-effective decision-making processes which (a) are aligned with national performance goals, (b) are responsive to local conditions and risks, (c) utilize formal analytic risk management tools and (d) effectively engage marine transportation system stakeholders. This strategy has been identified as the acquisition of a core competency in risk-based decision-making (RBDM).

The Risk-based Technologies Group at the U.S.C.G. R&D Center has supported the above strategy by developing a set of RBDM Guidelines for district and field level use. The first edition of the guidelines was released in 1998 and a second improved edition was recently released.[13] This paper examines the goal of acquiring competency in RBDM as an example of organizational change. A satisfactory transformation of field level decision-making processes to reflect this competency has yet to occur. An understanding of the decision making culture within CG Marine Safety Offices (MSO) and a review of the research literature on organizational change provide insight as to why the desired transformation has not occurred. This insight gives direction on how an effective distance-learning course in RMDM may assist in the organizational development of a core competency in RBDM.

2. Background

Based on a review of decision-making in MSO units, the current practice is largely, an informal, qualitative process. Historically, the majority of MSO personnel is educated in technical and engineering disciplines and do not typically receive formal training in the areas of business process reengineering, information technology, risk management and stakeholder negotiations. Yet, it is these areas that are closely linked to the desired competency in RBDM. Traditionally, CG personnel learn decision-making skills through the experiential process of meeting one's job responsibilities which is usually not the vehicle for creating organizational change. To date, the primary step that has been taken to facilitate competency in the use of formal analytic approaches to RBDM has been the development of the RBDM Guidelines.[13] The Guidelines have presented a variety of RBDM tools in generic forms but the specific processes for applying them to marine safety and environmental protection applications have not been fully developed.

The literature on organization change offers some explanation for the CG's lack of progress in establishing a core competency in RBDM. In a recent study, Beer and Nohria report that seventy percent of all organizational change initiatives fail.[3] The literature reports on factors, which correlate strongly with successful organizational change. Sink and Morris and, more recently, Koutnour report that successful organizational change must not only provide for the necessary resources (i.e. RBDM Guidelines) but, also, for process change requirements.[11, 8] For example, the tools in the RBDM Guidelines require input data. Objective field data for quantifying a tool's input requirements is generally not available, and a tool's application requires that MSO personnel devise information acquisition processes which utilize a combination of subjective and objective data. Personnel remain uncomfortable in making quantification when subjective judgements are needed to bridge gaps in data. The RBDM Guidelines contain little guidance on how to bridge these gaps.

Another factor linked to successful organizational change is the use of symbols and narratives to implement the vision for change.[12] Change introduces uncertainty and there must be an emotional process to propel individuals to make the necessary leap of faith.[6] Narratives which capture the essence, if not the full details, of change can help one visualize how the change can be successfully implemented. Research has shown that

successful change requires a reward system. For organizations to be receptive in implementing a change there must be clear expectation for adding value.[1] Formal analytic approaches to RBDM require more time and effort. If CG personnel do not see the output from a formal analytic approach as bringing more credibility either with CG Headquarters or local stakeholders, then there is no motivation to put in the extra effort that such an approach will require. Presently, the RBDM Guidelines provide general discussion on the benefits from formal analytic tools but there is no practical discussion or narrative on more concrete job benefits that one can expect to accrue from using the Guidelines.

The literature also reports that successful change must provide a transition from the past. If new frameworks are to be successful they must somehow retain the old while introducing the new. [10] Here, the desired transition is from informal qualitative RBDM to formal analytic RBDM. Heretofore, the RBDM Guidelines have presented formal analytic RBDM as a replacement to the informal qualitative processes. In the authors' opinion this has left the door open for MSO personnel to reject formal analytic RBDM as lacking the needed flexibility that only a qualitative process can provide. It has been a mistake to present the adoption of formal analytic RBDM as a replacement process when it should be framed as an improvement to the status quo.

3. Course Design

This paper explains a proposed course design for marine safety and environmental protection professionals in the United States Coast Guard (CG). The course is intended to further support the CG's goal for building competency in formal analytic approaches to risk-based decision-making. In a fundamental sense, MSO personnel are risk managers who seek, through education, prevention and response, to guard against mishaps that may occur in their area of responsibility (AOR). A representative list of their decision-making problems are shown in Figure 1. The list moves from high-level programmatic decisions with longer time frames down to more detailed short-term decisions. In each case there is the common ground of seeking to manage performance (i.e. risk) within their AOR through the cost-effective utilization of limited resources.

First and foremost, the course design will be contextual working from representations of the decision-making problems that are listed in Figure 1. From these representations the concepts, methodology and tools for effective risk-based decision-making are introduced. The result will be an integration of material from decision/risk analysis, information technology and stakeholder negotiations. The integration is captured through a basic risk-based decision-making framework that is shown in Figure 2. Course content will be structured into three modules: 1) a set of mini-cases, 2) tools/methodology and 3) full-scale case studies.

Figure 1: MSO Decision Making Processes

MSO Business Planning
- Establishing Port/Waterway Management Priorities
- Establishing Monitoring and Surveillance Plans
- Establishing Prevention Controls for Specific Activities

Inspection Planning
- Prioritizing Targets for Inspection
- Planning Inspection Processes for Specific Targets
- Process Planning for Port/Waterway Operations

Contingency Planning
- Establishing Response Priorities
- Establishing Specific Response Plans
- Planning Investigations

Special Studies
- Determining Equivalency Among Different Requirements
- Approving and Controlling Marine Events
- Changing Regulatory Requirements

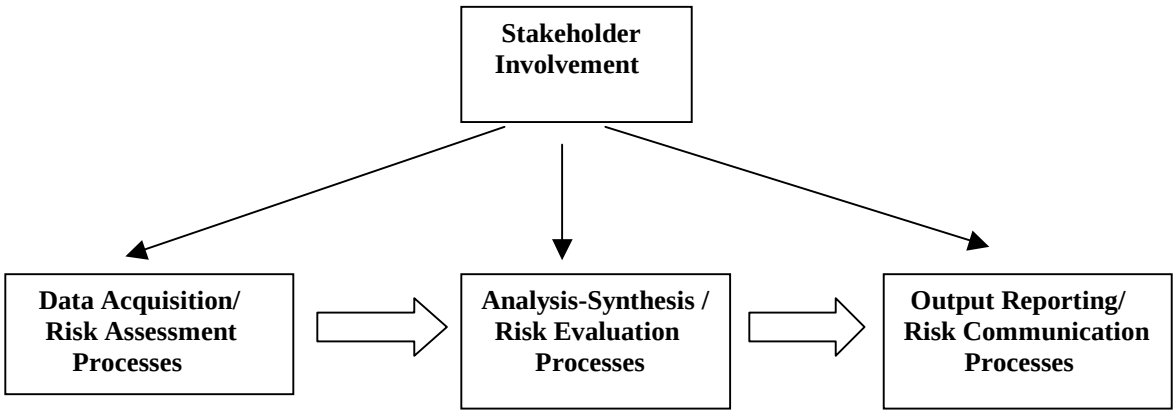

Figure 2: Basic Risk-based Decision-Making Framework

3.1 Case Studies in RBDM

Module 1 is planned to cover three mini-cases: Risk-based Business Planning, Risk-based Inspection and Contingency Planning. Module 3 will address the same case studies giving a more complete report of the application. The mini-cases will hold the pedagogical key for promoting the adoption of formal analytical methods in RBDM. Each mini-case will be designed to tell a story on how the basic paradigm in Figure 2 can be applied in a particular decision making context. The story must accomplish several things. First, it must be sufficiently simple that it can be received without intimidating the learner. At the same time, it must capture the context with reasonable accuracy that the learner will not dismiss the story as being unrealistic. The story must also show how a formal analytic approach to RBDM can add value and, finally, it must clearly address how informal, qualitative RBDM can be integrated with formal analytic RBDM (i.e. a transition which honors the status-quo while introducing change).

The case studies are under construction. The case on business planning is being developed with the help of MSO Portland, ME. and the case on risk-based inspection is being developed with the help of MSO Boston (and possibly MSO New Orleans). A MSO site for developing a case on contingency planning is currently being sought.

Consider business planning to briefly highlight the challenge in building an effective mini-case. At the MSO level, a major concern is with performance objectives for the next year where business planning is fundamentally a means-ends analysis. Figure 3 presents a generic model of the business planning process for an MSO. The process begins by setting strategic performance objectives (i.e., ends) for the business unit, and proceeds to operationalize these objectives by identifying the most cost-effective action plans (i.e., means) for achieving the stated goals. Presently, most MSOs address steps 1 and 7 on a formal analytic level while steps 2-6 are typically covered on an intuitive, qualitative level. The challenge in constructing the business planning mini-case is to illustrate how steps 2-6 can be approached on a formal, analytic level without overwhelming the learner.

1. Develop/ Prioritize MSO's Risk-based Performance Objectives (RPO).
2. Identify MSO's Waterway Activities which Impact RPO.
3. Risk Assessment of each Waterway Activity.
4. Identify Alternative Action Plans for Reducing Risk.
5. Assess Resource Requirements and Effectiveness of Action Plans on RPO.
6. Construct Business Plan: Select/ Prioritize a set of Action Plans within Budget.
7. Measure Achievement with RPO in Upcoming Budget Period.

Figure 3. MSO Business Planning Process

3.2 Tools/Process Methodology

Currently, the CG's RBDM Guidelines cover a wide variety of decision and risk analysis tools.[13] The intended course will cover fewer tools and include important material from business process reengineering and activity based management.[4, 5, 7] Regarding methodology, the course will teach the student how to interface risk analysis tools with the tasks of data acquisition and risk communication.[2, 9] On the latter, MSO units maintain active involvement with a waterway's stakeholders through organizations such as harbor safety committees and the effective communication with external stakeholders is an important means for improving the quality of both the decision-making process and the implementation of results.

3.3 Course Format

Present manpower constraints and increased demands for operational readiness at MSO sites make leaving one's post for education and training difficult. This fact along with the geographic dispersion of MSO personnel argue strongly for providing the course on RBDM as a continuing education product through a web based distance-learning format. One of the authors has experience in delivering a more general course in operations risk management to graduate engineering students through a distance-learning format. That course has successfully used the web-based software, Blackboard, which supports E-Learning in more than 3000 different learning institutions. Much of the work in creating the new course will be the customization activity of completing the case studies. For students, successful completion of this continuing education course would involve passing self-administered tests which Blackboard accommodates and satisfactorily completing a course project which would be based on applying the course tools/methodology to one of the problem types in Figure 1 for the student's particular MSO.

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