A DECISION ANALYSIS PROPOSAL TO STRENGTH INDUSTRIAL COMPLIANCE OF MARITIME EDUCATION AND TRAINING PROGRAMS

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ABSTRACT

Maritime educational program development responding to the industrial tendencies has recently become a challenging issue. In fact, International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) sets competencies for maritime professionals in different ranks. However, it is so important to reconsider the relevant qualification standards and field expectations together. This paper illustrates a basic decision analysis particularly on STCW Code Table A-III/2 in order to identify the priorities of competencies in program development. In this case, Analytic Network Process (ANP) is adapted as a suitable technique to ensure dependencies and feedbacks between the competency items under different functions such as marine engineering at the management level, electrical, electronic and control engineering at the management level, maintenance and repair at the management level, etc. The initial results are useful to balance the methods for demonstrating competence (i.e. simulator training, laboratory equipment training, training ship experience in-service experience, etc.). As a further study, the proposed approach might be extended as a quality assurance tool strength the industrial compliance of program outcomes.

Keywords: maritime education and training, ANP, industrial compliance, marine engineering

1. Introduction

Researchers and professionals in the field of maritime policy and management have been enthusiastically driven by the increasing popularity and development of the maritime transportation business in international trade. Maritime transportation's role as a vital tool for global trade, linking producers, manufacturers, and consumers worldwide, will continue to expand. It is certain that technological advancements will drastically alter employment patterns in the maritime field in the next years, and that the skillsets and training requirements for the shipping industry's immediate, medium, and long-term will be different than they are now (Cicek et al., 2019). The mandatory minimum requirements for certification of chief engineer officers and second engineer officers are defined in STCW Code Table A-III/2 under the functions. Some of these functions are marine engineering at the management level, electrical, electronic and control engineering at the management level, maintenance and repair at the management level, etc. Methods for demonstrating and developing competencies are also given. Examples are approved training, approved in-service experience, approved simulator training, and approved laboratory equipment training. Nevertheless, it is crucial to reevaluate the appropriate qualification standards and field expectations together. This article demonstrates a basic decision analysis, focusing on STCW Code Table A-III/2, in order to determine the priority of competencies in program development. In this instance, ANP technique is adapted as an appropriate technique to ensure dependencies and feedbacks between competency items under various functions.

2. Literature Review

When the studies on the minimum standards that seafarers should have examined, it is seen that there are gaps between the existing STCW and the new generation maritime competencies. For example, the requirements of distance education and simulation applications as a new perspective to maritime education were analyzed. In the study, it was emphasized that in line with the current maritime needs, new technologies such as computers and simulators should be included more in the training (Koroleva et al., 2018). In another study, the importance of the skills that may be required for maritime in the short-medium-long term and their importance for the maritime sector was emphasized. Capabilities are divided into titles such as social, personal, and technological and these are also examined (Cicek et al., 2019). In addition, there are studies in which maritime training education (MET) competencies are mentioned and the use of methods such as VR, AR, and gamification as future technologies are mentioned. As can be seen here, simulation studies are of great importance (Sharma and Nazir, 2021).

Although there are studies in the literature on STCW and MET, a detailed study of the prioritization of competencies in STCW Table A-III/2 to ensure industrial compliance to contribute to scientific studies and maritime stake holders such as maritime training centers, universities and ship management companies.

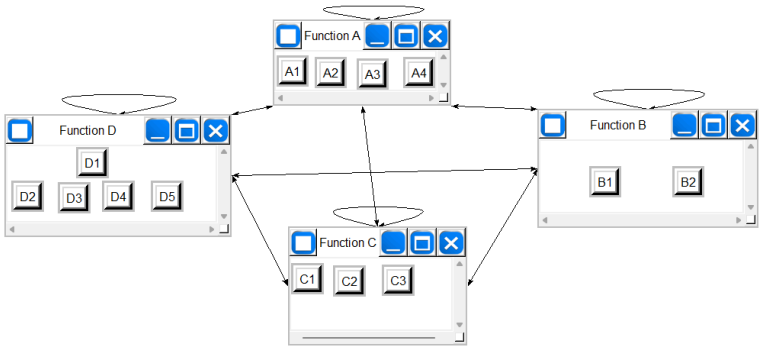
3. Objectives

Development of maritime educational programs in response to industrial trends has recently become a demanding subject. In reality, STCW specifies the qualifications required of maritime professionals of various ranks. Nevertheless, it is crucial to reevaluate the appropriate qualification standards and field expectations together. This article demonstrates a basic decision analysis, focusing on STCW Code Table A-III/2, in order to determine the priority of skills in program development.

4. Methodology

The first step of the ANP approach entails creating a control criterion whose components involve dependencies and feedbacks. This study describes the numbers and relevant parameters for four clusters (Function A, Function B, Function C, and Function D). After identifying the assessment criteria for the problem, the model's structure is developed by establishing inter-cluster linkages and inter-cluster dependencies. Figure 1 shows the fundamental framework of the suggested multi-criteria evaluation model in *SuperDecisions Software* when the existing links between the significant components are established.

Figure 1. Basic model structure in SuperDecisions Software



The final step is entering data into the SuperDecisions software. At this point, a number of marine industry professionals are consulted for their aggregate insight on matched

comparisons. The experts were required to have relevant experience and expertise in the field of maritime education, ship owning/operating company, maritime research, professional seafarers such as chief engineers, second and third engineers, and other areas such as port operator and offshore platforms. In total, thirty experts participated in this study. There are 20% of the experts have more than 15 years of experience in the maritime industry while holding positions such as ship owners, non-technical skills training providers, chief engineers, port operators, and offshore platform engineers. Also, there are over 30% of the experts whom professional seafarers, and over 25% of the experts have maritime training backgrounds.

5. Model Analysis

This study defines the numbers of four clusters and relevant factors. Table 1-4 illustrate the functions in STCW mandatory minimum requirements for chief engineer and second engineer officers respectively.

Table 1. Function A: marine engineering at the management level (STCW Code Table A-III/2, 1978)

Function A: Marine engineering at the management level	Code
Manage the operation of propulsion plant machinery	A1
Plan and schedule operations	A2
Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery	A3
Manage fuel, lubrication and ballast operations	A4

Table 2. Function B: electrical, electronic and control engineering at the management level (STCW Code Table A-III/2, 1978)

Function B: Electrical, electronic and control engineering at the management level	Code
Manage operation of electrical and electronic control equipment	B1
Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition	B2

Table 3. Function C: maintenance and repair at the management level (STCW Code Table A-III/2, 1978)

Function C: Maintenance and repair at the management level	Code
Manage safe and effective maintenance and repair procedures	C1
Detect and identify the cause of machinery malfunctions and correct faults condition	C2
Ensure safe working practices	C3

Table 4. Function D: controlling the operation of the ship and care for persons on board at the management level (STCW Code Table A-III/2, 1978)

Function D: Controlling the operation of the ship and care for persons on board at the management level	Code
Control trim, stability and stress	D1
Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea, security and protection of the marine environment	D2
Maintain safety and security of the vessel, crew and passengers and the operational condition of life-saving, fire-fighting and other safety systems	D3
Develop emergency and damage control plans and handle emergency situations	D4
Use leadership and managerial skills	D5

Table 5 shows the global priority weights for mandatory minimum requirements for the chief engineer and second engineer officers.

Table 5. Global Priority Weights on competencies

Code	Limiting Values	Normalized Values	%
A1	0.110	0.340	%34
A2	0.026	0.080	%8
A3	0.121	0.374	%38
A4	0.065	0.203	%20

B1	0.136	0.627	%63
B2	0.081	0.372	%37
C1	0.059	0.272	%27
C2	0.065	0.301	%30
C3	0.092	0.426	%43
D1	0.054	0.225	%23
D2	0.083	0.347	%35
D3	0.062	0.258	%26
D4	0.015	0.064	%6
D5	0.025	0.103	%10

6. Limitations

STCW Table A-III/2 was examined in the study. In future studies, other parts of the STCW may be examined for a more detailed training program and analysis.

7. Conclusions

This paper identifies the priorities of competencies under the functions for the mandatory minimum requirements for the chief engineer officers and second engineer officers. The results indicate that operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery (%38) in Cluster A, manage operation of electrical and electronic control equipment competency (%63) in Cluster B, ensure safe working practices (%43) in Cluster C, Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea, security and protection of the marine environment competency (%35) in Cluster D are appeared correspondingly as significant competencies among the competencies. The outcomes of this study can be utilize as decision aid for designing the education and training program to strengthen the industrial conformity, moreover, for setting and planning of the general priorities within training centers. The proposed method could be utilized as a quality assurance instrument to strengthen the industrial conformity of program outcomes.

8. Key References

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