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Assessment of ISPS Code Compliance at Ports Using Cognitive Maps

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ABSTRACT: International ship and port facility security (ISPS) Code was developed by the International Maritime Organization (IMO) as an execution framework to ensure high level of security measures applicable to ships and port facilities. Besides contributions of ISPS Code towards security improvement, additional bureaucracy (i.e. documentation, certification, training, expenses etc.) and serious shortfalls have appeared during implementation process. This paper explores the ISPS Code practice at ports based on cognitive mapping approach. The outcomes of this research can be proposed to international maritime authorities in order to enhance the existing concept and regulatory compliances of the ISPS Code in respect to industrial feedback.

1 INTRODUCTION

Security in maritime transportation is one of the focal issues of maritime interests. This dilemma requires setting critical measures and initiatives, which should effectively be designed and implemented. In this case, the consequences of security improvements are also beneficial to service quality and business performance in international shipping (Thai, 2007).

To provide a standardized framework for implementing security precautions and to control the potential risks for ships and port facilities, practicing of an international ship and port facility security (ISPS) code was initiated by the International Maritime Organization (IMO) (Hesse & Charalambous, 2004; King, 2005). The ISPS code establishes cooperation between government agencies and the shipping and port industries in perception of security threats and preventing security incidents affecting ships in ports (Mensah, 2004). The implementation of the ISPS code necessitates following well-designed procedures to capture most of the probable risky situations in a quick response. Thus, it requires both flexible and consistent plans to overcome all those unexpected circumstances (Tzannatos, 2003).

The aim of this paper is to delineate the current implementation procedure of the ISPS Code at container terminals. Specifically, cognitive mapping approach is utilized to model the industrial feedbacks about the shortcomings of the ISPS Code. Consequently, a simple representation of the raised problems in ISPS Code practice is graphically demonstrated.

2 COGNITIVE MAPS

2.1 *Cognitive mapping*

Cognitive mapping is the task of delineation a person's thinking about a problem or issue. Initially, Tolman (1948) introduced the fundamental principles, which have been referred as guidelines for cognitive psychology research. A cognitive map approach ensures participations of the decision makers' motivation through creative decision-making. In addition, it is an active tool, which allows modification of dynamic attributes in problem environment in accordance with the prior settings and goal.

The structure of a cognitive map mainly captures causal dependencies (Srinivas & Shekar, 1997), thereto; it also provides a graphical representation of different problem cases (Axelrod, 1976; Eden, 1990). In problem construction stage, a node represents the concepts while a number of arcs schematize existing directional relationships among these nodes. Symbolical representation of links is settled using a unidirectional arrow. A statement at the tail of an arrow is taken to cause, or influence, the statement at the arrowhead. According to the casual relation type among concepts (represented by nodes), a minus/plus sign is located on the arrows.

Since it provides satisfactory solutions to many case studies, cognitive maps have been applied sev-

eral eras in literature (Kitchin & Freundschuh, 2000).

2.2 *Linking up with ISPS Code Practice at Ports*

The previous subchapter was intended to provide an introduction to cognitive mapping. Whereupon, it is an onerous task to comply a decision analysis model with serious shortfalls in ISPS Code implementations. In detailed model construction, the mostly encountered problems regarding with regulatory compliances of ISPS Code requirements onboard ships are represented via nodes. The decision analysis aims at achieving two points: (1) Clarifying the casual relations and effects among shortfalls from ship operators' perspective, (2) Formulating further strategies to revise ISPS Code.

3 PROPOSED APPROACH

3.1 *ISPS Code*

The ISPS Code consists of two parts. Part A is mandatory. It contains detailed security related requirements for governments, port authorities, and shipping companies. Part B contains a serious of guidelines about how to meet these requirements. Furthermore, the conference adopted a number of resolutions, in order to facilitate the implementation and the application of those security measures to ships and port facilities. Table 1 outlines the mandatory requirements of the ISPS Code.

Table 1. Mandatory requirements of ISPS Code

Requirements	
Section 1	General
1.1	Introduction
1.2	Objectives
1.3	Functional requirements
Section 2	Definitions
Section 3	Application
Section 4	Responsibilities of Contracting Governments
Section 5	Declaration of Security
Section 6	Obligations of the Company
Section 7	Ship Security
Section 8	Ship Security Assessment (SSA)
Section 9	Ship Security Plan (SSP)
Section 10	Records
Section 11	Company Security Officer (CSO)
Section 12	Ship Security Officer (SSO)
Section 13	Training, Drills and Exercises on Ship Security
Section 14	Port Facility Security
Section 15	Port Facility Security Assessment
Section 16	Port Facility Security Plan
Section 17	Port Facility Security Officer
Section 18	Training and Drills on Port Facility Security
Section 19	Verification and Certification
19.1	Verifications
19.2	Issue or endorsement of certificate
19.3	Duration and validity of certificate
19.4	Interim certification

3.2 *Feedbacks from Maritime Industry*

Industrial feedbacks and technical reports on ISPS Code-related concerns affecting ships are essential to identify and address the probable problems, which may arise. At this insight, the common idea focuses on excessive pressure of expectations regarding with the ISPS Code. Sometimes, those limitations create some trading disadvantages and operational constraints for merchant ships. Especially, the following items are highlighted about security related matters, which affect the operations of merchant ships (ICS, 2008):

- Additional information demands from port state inspector such as security plan, disclosure, etc.
- Availability of ongoing problems in respect of the continuous synopsis record, records of training, and drills.
- Excessive attitudes of port state control (PSC) officers such as use/display of firearms, crew interrogation, aggressive attitudes, placing armed guards, refusal of access to shore facilities/shore leave.
- Maritime security (MARSEC) level incompatibility between ship and port facility.
- Problems over agreement on a declaration of security.
- Excessive information demands before entering port, current and historical information (e.g. port, customs, and immigration).
- Problems caused by trading history (previous calls at non-compliant port facilities, previous ownership or flag).
- Limitations on access control issues such as identification (requested/provided), manning access points, searching visitors, accompanying visitors, securing waterside access, access to ships for essential visitors.
- Establishment of restricted areas on board and ashore and securing access to them (e.g. bridge, engine room, accommodation).
- Monitoring of deck patrols, landward and seaward monitoring.
- Use of additional security equipments such as automatic identification system (AIS) and ship security alert system.
- Considering security measures for storing of any delivered spares and provisions.
- Additional supervision requirements and integrity in cargo related operations.
- Commercial consequences of delay, detention, refusal of entry or departure, and additional inspections.
- Time constraints to correct the perceived ship security deficiencies.

3.3 *Cognitive Map Construction on Shortfalls of ISPS Code Implementation*

Following the industrial feedbacks, representation of the implementation shortfalls of the ISM Code based on a cognitive map structure is constructed in respect to the following dimensions: (i) Goal, (ii) Variables, (iii) Casual relationships among the variables. The goal is predefined as "How can we achieve the regulatory compliances of the ISPS Code in respect to industrial feedback?" On the other hand, the variables, which include both shortfalls and key implementation items of ISPS Code, are given as follows:

V_1: Additional information demand
V_2: Excessive workload onboard
V_3: Immigration bureaucracy
V_4: Port custom facilities
V_5: Security plan
V_6: Drill and training records
V_7: Use of security equipment
V_8: Manning of access points
V_9: Securing waterside access
V_{10}: Essential visitors' control
V_{11}: Securing restricted areas
V_{12}: Excessive attitudes of PSC officers
V_{13}: Crew fatigue and stress
V_{14}: Commercial consequences of detentions
V_{15}: Refusal of entry or departure
V_{16}: Time constraints at port period
V_{17}: MARSEC level incompatibility

It is the next issue to define existing casual relationships in three different forms:

(i) Positive (+)

(ii) Negative (-)

(iii) No relationships (0)

At this insight, the casual relationships among the variables can be beneficial to formulate enhancement strategies through ISPS Code implementation at ports. Those strategies might include an integrated action plan, combined execution of excessive procedures based on a unique scheme, elimination of unnecessary issues, and other countermeasures. Table 2 addressed the construction of a square matrix including all concepts related to ISPS Code implementation.

Table 2. Square matrix of concepts

	V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	V_9	V_{10}	V_{11}	V_{12}	V_{13}	V_{14}	V_{15}	V_{16}	V_{17}
V_1	0	+	0	0	0	0	0	0	0	0	0	0	+	0	0	+	0
V_2	0	0	0	0	-	0	0	0	0	0	0	0	+	0	0	0	0
V_3	+	0	0	0	0	0	0	0	0	0	0	+	0	0	0	+	0
V_4	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0
V_5	+	+	0	0	0	+	0	+	+	+	+	0	0	0	0	+	0
V_6	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_7	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0	+
V_8	0	+	0	0	0	0	0	0	+	+	+	0	+	0	0	+	0
V_9	0	+	0	0	0	0	0	+	0	0	0	0	+	0	0	+	0
V_{10}	+	+	0	0	0	0	0	-	-	0	-	0	+	0	0	+	0
V_{11}	0	+	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0
V_{12}	0	0	0	+	0	0	0	0	0	0	0	0	+	0	+	0	0
V_{13}	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	+	0
V_{14}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V_{15}	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	+	0
V_{16}	0	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0
V_{17}	+	0	+	-	-	0	0	0	0	-	0	+	+	0	+	+	0

Furthermore, in Figure 1 schematizes the focused problem in accordance with the cognitive mapping principals. Broadly, two kinds of concept are defined: implementation shortfalls (V_1, V_2, V_3, V_{12}, V_{13}, V_{14}, V_{15}, V_{16}, V_{17}) and regular items (V_4, V_5, V_6, V_7, V_8, V_9, V_{10}, V_{11}). The blue lines show the positive casual relation (+) while the lines with red colour indicate the negative casual relation (-).

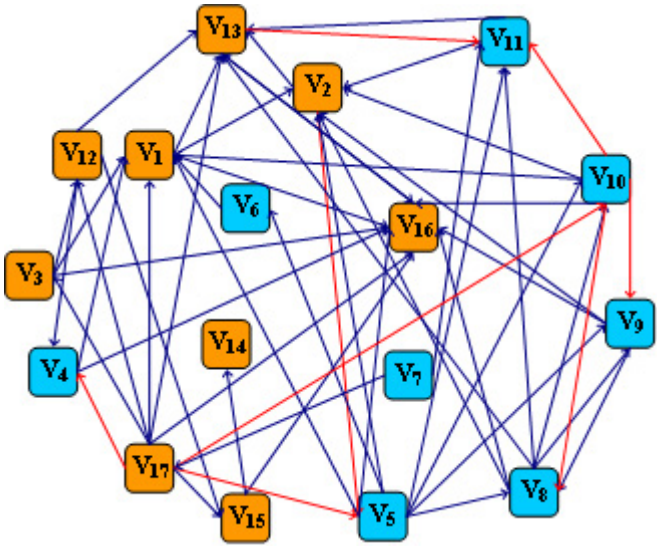

Figure 1. Cognitive mapping of ISPS Code implementation

It is the final stage of this approach to transform those relations into useful information to enhance ISPS Code implementation. In this progress, all the negative effects against routine implementation items, in addition, positive relations that increase the degree of implementation shortfalls should be eliminated.

To quantitatively support this stage, centrality value for each concept can be guided. Centrality of a concept is a measure in application of cognitive mapping approach. Centrality means a reference point to indicate the importance of a concept in a map (Eden et al., 1992). To compute the centrality,

the row/column sums of the absolute values (means the direction of the links is ignored) of existing relations are principally considered. Table 3 gives the computed centrality values for each concept of the problem at hand.

Table 3. Centrality values for concepts

Concepts	Centrality Value
V_{16}	11
V_5, V_{10}, V_{13}, V_{17}	10
V_8, V_1	9
V_2	8
V_{11}	7
V_7, V_9	6
V_{12}	5
V_3, V_4, V_{15}	4
V_6	2
V_{14}	1

According to the initial findings, time constraints at port period are appeared as the most significant matter in ISPS practice at ports. Hence, the relevant maritime authorities need to reduce time-consuming requirements of ISPS Code. To do so, the centrality values and the proposed network in Figure 1 can collaboratively be utilized. Just to name a few underlined issues in detail, the current procedures for security plan and essential visitors' control can be revised. Relevance to ensure collaboration between maritime shareholders, the compliances between MARSEC levels for ships and port authorities need to be rearranged. In addition, the influences of expectations from shipboard personnel, which increase the crew fatigue and stress, should clearly be eliminated. In respect to the centrality values of concepts, a number of enhancement strategies with priorities towards ISPS Code practice at ports can be suggested to maritime authorities.

4 CONCLUSION

Ensuring regulatory compliances with participations of different shareholders in maritime industry is one the focal issue. An effective maritime legislation extremely depends upon the consensus among the market players and relevant international authorities. Specifically, this paper mainly deals with exploring the potential influences of the ISPS code practice at marine ports. Hereto, a number of industrial feedbacks on ISPS practice at ports, which pictures a socio-technical phenomenon, are gathered. To solve this kind of dilemmas, analytical techniques are generally inadequate for dealing with interrelationships or causalities among a set of individual and social concepts. Instead, this paper used cognitive maps to cope with this type of causalities. It underlined some hints to support probable revision efforts on ISPS Code from an interdisciplinary viewpoint. The proposed decision analysis based on a cognitive mapping approach ensured an invaluable findings and straightforward roadmap for the further studies on enhancement of maritime security.

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