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A decision support methodology for risk management within a port terminal

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ABSTRACT

The objective of this paper is to analyze and assess operational risk within the port terminals at the RO–RO activity. The paper proposes a specific methodology based on AHP multicriteria approach. After detection of the inherent risk of process and estimation of the both gravity and level of mastery we judge against two approaches in order to identify the most critical risks and to establish preventive measures.

1. Introduction

Today in the era of globalization and competition, industrial companies focus more and more on their heart activity and outsource other tasks out of their areas of expertise. Hence flows of goods have increasingly growing and development of international intermodal transport networks. With the arrival of container, handling is standardized and transit time from one mode of transport to another has significantly decreased. However, the passage through the port terminal still the weakest link in the intermodal transport chain, for this reason the need to optimize port management in order to accelerate and reduce the cost of moving the goods through the port. Optimization of operations within the port container terminal is very important, because the charging time has a great impact on the economic viability, hence the importance for the efficiency and effectiveness of the identification and the mastery of inherent risks (Mabrouki et al., 2013a,b).

Risk management is "the adoption of financial, technological and organizational changes to the relationship between environmental turbulence and variability in the results ..." (Aubert and Bernard, 2004, p. 8). It may be defined as "a coordinated set of activities that are performed by an organization to identify, measure, evaluate and modify both the probability of occurrence of certain events that may have an impact on one or more entities, and the impact of these events on the entity" (Aubert and Bernard, 2004).

The port management is exposed to several types of risks e.g. damage when unloading a vehicle, theft of cargo, etc.

Risk management is based primarily on the analysis and assessment of all relevant and available information (Hallikas et al., 2004). This process is usually structured around five phases (Dorofee et al., 1996):

(1) Identification of risks. Is a step to identify the risk factors, the triggering events, their causes and their potential consequences.
(2) Risk analysis, is to determine the nature and level of risk. In addition, risk analysis provides a picture of the causes and consequences and aims to describe the risk either qualitatively (in terms of type of risk) or quantitatively (in terms of criticality) (Aven, 2008).
(3) Planning and scheduling preventive and corrective actions.
(4) Monitoring and implementation of action plans.
(5) Effectiveness monitoring of measures taken via mechanisms of prevention and protection.

It is important to note that communication is essential throughout the process of risk management (Fig. 1).

In the industrial environment, port activity is one of the more complex components of the supply chain where risk management is present on financial, technological, organizational and operational aspects. With over 80% of world trade carried out by sea, port terminals are vital to the development of international trade (Siim Kallas, Vice President of the European Commission 2012). The safety of maritime transport has thus become an essential condition for the proper functioning of economies. Faced with this sit-

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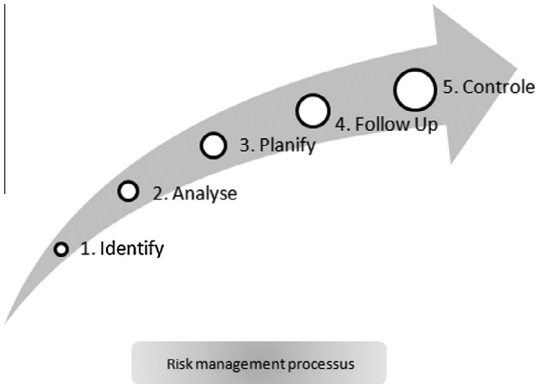

Fig. 1. Risk management process.

uation, a number of international standards have emerged, including: ISPS, C-TPAT, CSI (Barnes and Oloruntoba, 2005; OECD, 2003). Standard ISPS (International Ship and Port Security) corresponds to the security of ships and facilities. All ships and terminals were subjected to ISPS security officers and the ship or the port facility assessments and security plans. C-TPAT, probably an extension of the partial CSI, works a little differently because it covers not only the maritime sector; but it actually covers the entire chain (Fig. 2).

The operational level of port terminals is characterized by huge infrastructure and critical resources as limited and rapidly changing traffic. Such an environment so complex, has led many points of failure at several levels, such as administrative activities, operations management, incident management, facilities management, and infrastructure management. Such problems require a particular methodology to identify and assess operational risks in order to establish preventive measures in port terminals.

At the studied port, vehicle traffic activity roll-on/roll-off (RO–RO) represents more than 70% of the port traffic (Port of Casablanca, Morocco 2012). It is quite natural to master the port offer to the evolution which becomes more and more interesting and more complex to manage. However, a good traffic management, improved service quality and especially the satisfaction and loyalty of customers are the keys to success and have good governance. This is why the activity RORO (roll-on/roll-off cargo) is engaged in a dynamic sustainable implementation of risk management devices to guarantee better control of operational risk. Moreover, the analysis of the historical evolution of risks has led to the identification of a gap between the reality of operational risk at the field level and risk management policies currently adopted. Hence the need for reassessment of risk in operational activity RO–RO in terms of nature of gravity and level of mastery.

This paper is organized as follows: a literature review of the proposed approaches to risk management is set out in Section 2. The issue of port terminals in the port of Casablanca is presented in Section 3. A specific method adapted to the problem based on a multi-criteria approach is described in Section 4. Finally and before concluding the results are presented and analyzed in Section 5.

2. Literature review

Risk assessment is hardly a new or novel undertaking: as individuals we intuitively analyze, assess and decide upon risky situations or life choices with inherently uncertain outcomes as part of everyday living (Eduljee, 2000).

Nowadays, the maritime and port terminal activities risk assessment is an important research theme. Like this, many studies have been realized to analyze and identify risk (Degré, 2003; Glansdorp, 2004; Regelink et al., 2004; Van der Heijden et al., 2004; Wang et al., 2004; Sage, 2005; Haj-Salem et al., 2006).

The issue of risk management has been studied for a long time in the supply chain (Tang, 2006), but it has been an important development in the field of transport especially in maritime transportation. In the literature, several researchers have addressed this notion in road transport (Bubbicoa et al., 1998; Forta et al., 2010; Scenna and Santa Cruz, 2005; Van Raemdonck et al., 2013), rail transportation (Gheorghea et al., 2005; Elms, 2001) and air (Roelen et al., 2011; Darbra and Casal, 2004; Kirkland et al., 2004; Attaccalite et al., 2012; Janic, 2000).

In the maritime studies, the risk was a central issue because it is often coupled with the safety, efficiency and reliability of transport (Kristiansen, 2005). While efforts have been devoted to the analysis of the safety performance of ships (Alderton and Winchester, 1997; Yip, 2008; Hu and Zhang, 2012; Wang et al., 2014), identification of risk ships (Wang, 2001; Degré, 2003; Balmat et al., 2009; Liwång et al., 2013; Ikeagwuani and John, 2013) or the safety of passenger ferries (Talley, 2002; Talley et al., 2006). Our work is more interested by the identification, analysis and the assessment of risks in the management operating system within the port terminal.

Without being exhaustive, the techniques most commonly used in engineering risk are classified as quantitative, qualitative or a mix methods (Fera and Macchiaroli, 2010). See Table 1.

3. Process description

The business process management of roll-on/roll-off (RO–RO) within the port terminal consists of three main steps: (1) planning and making available the human and material resources; (2) operational management import and/or export and (3) billing and collection (Fig. 3).

First step, after receipt of the manifest (a document that contain information details about cargo). The agent of the park looks at the number of vehicles and brands to discharge (in order to inspect and detect a possible non conformity). It specifies the number of conductors required for the routing of vehicles for loading or/and unloading from/to the vessel.

Second step, the agents specify the park and reserve the exact area for the storage of vehicles (in order to confirm the initial reservation). After docking the vessel wharf agent balance the ramp of the vessel (mobile) with the ramp (fixed) or dock to ensure the stability of the vessel. Drivers land the vehicles at the dock (depending on the loading and unloading plan developed by the board). Pointer Company lands the number of vehicles and simultaneously

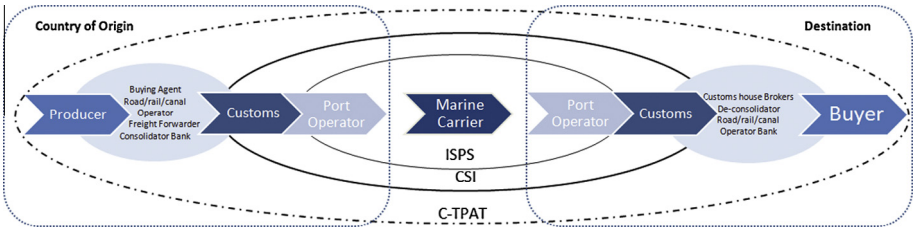

Fig. 2. Scope of IMO and US maritime security initiatives across a supply chain (OECD, 2003).