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Abstract Ports are complex, multiple-stakeholder environments representing the entrance point of intercontinental sea shipments into a country. Because ports are areas where large amounts of goods converge, they play a strategic role in a country's security and economic sustenance. Consequently different stakeholders interact to ensure that cargo handling operations are optimized and cost-effective, e.g. international shipping, logistics companies, trading communities, and regulatory bodies. In this context security threats assume a special relevance, since ports could be exploited by criminal organizations to smuggle illicit goods into a country or by terrorists planning an attack. To eliminate or mitigate these risks human resources need to be correctly trained and educated. In addition, the competent authorities need to ensure that the same level and quality of training is delivered to all port facilities providing access to a country or a continent. Unfortunately, experts believe that in the EU there is a lack of harmonization of courses and quality assurance systems. Hence, the aim of this study is to review existing regulatory frameworks and assess whether guidance is provided to harmonize security training and education in port facilities. Thereafter, based on the experience developed within other sectors, where harmonization of training and education courses in the EU has been successfully achieved, we make recommendations for improvement of the existing frameworks. The article concludes by summarizing the findings and indicating implications for managers and researchers.

Keywords Port security · Port security training · ISPS · Maritime security · Training and education · Vocational education and training · Supply chain security · Transport security

Introduction

Ports are complex, multiple-stakeholder environments representing the entrance point of intercontinental sea shipments into a country. There is a huge flow of goods converging

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in ports and consequently international shipping, logistics, and trading communities interact with each other as well as with regulatory bodies. For instance, between 2006 and 2010 the world container port traffic totalled 503.5 million TEUs with a growth rate of 116 % (IAPH 2011). A similar increase in traffic has been registered in EU-27 maritime ports where about 3 641 million tonnes of seaborne goods were handled in 2010, an increase of 5.7 % compared to available statistics from 2009 (Eurostat 2012). Hence, many experts agree that port facilities constitute a key infrastructure of international supply chains and national logistics systems and are directly responsible for a country's economy and welfare (Altiok 2011; Chulkov 2012). Consequently, it is of outmost importance to ensure that operations are kept safe, secure, and efficient at the same time.

Port facilities are part of the European critical infrastructure; this means that security needs to be continuously monitored and improved (Chulkov 2012). Typical threats in ports include theft, sabotage, and smuggling of illicit goods (Altiok 2011; Kothari 2008). Other threats are drug smuggling and stowaways, especially when shipments originate from countries where security standards are lower and criminals manage to perpetrate their illicit activities by simply infiltrating or bribing the local security officers (Medalia 2004). Terrorism is also an important threat. Since port facilities are sometimes located in close proximity to residential areas terrorists could detonate a nuclear device smuggled in a ship docked at a port. A potential explosion could cause extensive damage and severe environmental consequences (Averill 2010; Medalia 2004). Likewise, experts believe that a loaded LPG (liquefied petroleum gas) tanker could be hijacked and detonated in the vicinity of a port (Averill 2010). These risks should not be seen as far from reality, especially after the terror attacks in New York; even though airplanes were used in those attacks it is likely that ships could be used for the same purpose.

Previous studies have pointed out the importance of acting on the infrastructure layers of supply chains to ensure higher security; including all transport modes, facilities, and human resources involved in the movement of goods from the point of origin to the final destination (Urciuoli 2010). In particular, the training of human resources, including managers and operators, is an essential activity to eliminate a major weak point of supply chains. Statistics show that the majority of cargo crime, about 80 %, is perpetrated with the support of insiders, hence people working in the supply chain (Ekwall 2009; Urciuoli 2011). At the same time, it has been claimed that mistakes resulting from insufficient training of personnel have led to security incidents. For instance, Darbra and Casal (2004) highlight the importance of human resources in accidents taking place in ports. By analysing a total of 471 accidents in ports in 95 countries the authors find that about 14 % are sabotage actions, and hence unlawful.

To prevent security threats as well as to enhance the preparedness of port personnel to security threats, international organizations have developed extensive legislative frameworks and guidelines for seafarers and port owners. These are the SOLAS Chapter XI-2 and the ISPS code where mandatory requirements and guidance to secure ships and ports are expounded. These frameworks exalt the importance of training and provide guidance about how training activities should be performed as well as structured in a manner to facilitate harmonization across member states in Europe. Education and training means empowering the staff of port facilities and consequently building competences and skills to prevent, detect, and recover from dangerous situations caused by security events.

Many experts claim that very often security and training activities in port facilities are not well harmonized at an EU level. Legislative frameworks appear to be too

generic, allowing too much freedom for different interpretations, resulting in different security standards. This concern becomes crucial when implementing training or education at the EU level, where instructors need to deal with various contexts, threats, cultures, technologies, and different mind-sets of personnel and even of the instructors delivering the courses. Hence, we wonder whether it is true that existing legislative frameworks are sufficiently ambitious and whether they could be improved and how. Previous research in transport and supply chain security has mainly concentrated on the role of risk management processes in ports to harmonize security measures (Barnes and Oloruntoba 2005; Bichou 2004; Ekwall 2009; Harrauld et al. 2004; Mazaheri and Ekwall 2009). In addition, most existing works focus on the understanding of the impact of security on performance of supply chains (Goulielmos and Anastasakos 2005). Other research not focusing on supply chain or transport security has already studied the benefits of training and education in organizations (Senge 2006). In particular, relevant studies have been performed to show how to ensure that all relevant personnel in an organization may achieve the same level of ability, skills, and quality of performance (Quintino et al. 2011). Yet, we could not find any study that specifically analyses the problem of security training in port facilities. Hence, to our knowledge this area is still under-explored.

The aim of this study is to determine whether existing regulatory frameworks lack detailed instructions and guidance to harmonize security training and education in port facilities. Thereafter, we address how these frameworks could be improved. To accomplish this task we review existing maritime security regulatory frameworks and benchmark with existing research that has successfully developed harmonized training and education courses in Europe. The results of this benchmarking process are used to point out what is missing in current maritime security frameworks and recommend future efforts for managers, politicians, and researchers.

The structure of this paper is the following: after the introduction the literature reviewed is presented. This consists of legal frameworks in maritime security, codes, and guidelines to enhance maritime security and training (i.e. IMDG code and ISPS code), main organizations working with maritime security matters, and research carried out in the training and education area. Next, we discuss findings from research in training and education from the perspective of the reviewed guidelines for maritime security. Finally, in the conclusion we summarize the findings and provide recommendations for researchers and practitioners.

Method

The approach used in this paper consists mainly of desk research performed in existing literature, both in practice-oriented and scientific journals. Main keywords used in the searches are directly deducted from the main research questions. In particular, to identify topics and subjects relevant to define the keywords we followed a system approach, which is traditionally suggested in logistics research and also known to enhance holistic thinking (Aastrup and Halldórsson 2008; Checkland 1999; Gammelgaard 2004; Hellström 2007).

The main system examined in this paper consists of port facilities, where three main elements are discerned: maritime security training, legislative frameworks, and

techniques to harmonize education and training. This process was performed in accordance with the definition of a system given by Checkland (1999): “*The central concept ‘system’ embodies the idea of a set of elements connected together which form a whole, this showing property which are properties of the whole, rather than properties of its components*”. The three elements identified in this paper were first analysed independently and then assembled by analysing and reporting analogies, differences, and steps for improvement. This final process was necessary to ensure that the final results of the study were able to capture the interactions of the elements within the specific system. It is well known that the whole system is different from the sum of its components and that it is crucial to understand how the elements in the system interact with each other (Checkland 1999; Churchman 1968; Hellström 2007).

Literature review

The literature we reviewed has the main ambition to increase understanding of the following:

- Legal frameworks. Enforce security in the maritime sector, i.e. SOLAS Chapter XI-2 and ISPS, developed at the EU level.
- IMDG code. Covers the transport of dangerous goods by sea.
- ISPS code. Enhances security in ships and port facilities.
- Main organizations and regulatory bodies. Detail main stakeholders that today work with ships and security of port facilities.
- Education and training in ships and port facilities. Provide training, drills and exercises in ships and port facilities given in ISPS.
- Techniques to harmonize education and training. Review existing research in the field of education and training. Particular emphasis is given to Lifelong learning, Vocational Education and Training (VET), and harmonization work driven in Europe in other sectors.

Legal frameworks

The international legal framework for maritime security can be distinguished into criminal and regulatory laws (Mejia and Mukherjee 2004). The criminal law defines the maritime crimes and includes the United Nations Convention on the Law of the Sea (UNCLOS) and the Unlawful Acts Against the Safety of Maritime Navigation (SUA 2005; UN 1982). The regulatory law specifies all the possible measures that should be taken to prevent maritime crimes and is closely linked to the ISPS code and SOLAS (Fig. 1).

The ISPS code is divided into two parts, PART A and PART B. Part A includes mandatory requirements to ensure ships and port facilities are secure at all stages during a voyage, while part B provides non-compulsory detailed guidance for implementation.¹ The code “*attempts to influence the behaviours of seafarers and port managers through elaborate regulatory procedures as preventive measures in relation to combating*

¹ Some contracting governments in the US are implementing the ISPS code Part B on a mandatory basis (Bichou 2004).

Fig. 1 Role of SOLAS chapter XI-2, ISPS code on ship and port security

criminal offences that pose a threat to maritime security” (Mejia and Mukherjee 2004). The ISPS code is implemented through the SOLAS Chapter XI-2, where definitions and requirements for ships and port facilities are stated. Both the ISPS and the SOLAS chapter XI-2 state the importance of the introduction of security measures in the form of technical equipment, administration, and procedures, including training, drills, and exercises.

The definition of maritime security given in the ISPS Code and SOLAS is: “*those measures employed by owners, operators, and administrators of vessels, port facilities, offshore installations, and other marine organizations or establishments to protect against security incidents, terrorist attacks, seizure, sabotage, piracy, pilferage, annoyance, or surprise*” (Mejia 2003). In essence, the SOLAS and ISPS code quote that ensuring the security of ships and port facilities is a risk-management activity. Hence, to determine what security measures are most appropriate, risk assessment must be carried out for ships, shipping companies, and port facilities (Shiundu 2004).

IMDG code

The IMDG (International Maritime Dangerous Goods) code was developed in view of the recommendations given at the Safety of Life at Sea Conference in 1960. The Code proposes a “*uniform international code for the transport of dangerous goods by sea*” and may be seen as a supplement to existing regulations in SOLAS (IMO 2013). The IMDG code is split into two volumes and one supplement in which recommendations are given for diverse areas, i.e. packing, container traffic and stowage, stowage segregation and handling, emergency response action, recommendations for individual substances, materials and articles, and good operational practices (IMO 2013).

In recent times, the security of dangerous goods has assumed particular relevance, since terrorists could exploit this type of cargo. Hence, the IMDG code also covers

measures or precautions that should be taken by transport operators as well as managers of intermodal facilities, to minimize theft or misuse of dangerous goods leading to health hazards, injuries or damage of property and environment (BDG 2013). Chapters 1.3 and 1.4 of the IMDG code specify training activities in the following areas (BDG 2013; IMDG 2008):

- General awareness and familiarization (1.3.1.2.1)
- Function specific (1.3.1.2.2)
- Security Awareness (chapter 1.4)²

In particular, chapter 1.4 contains the following sub-sections (IMDG 2008):

- 1.4.2.3 Security training
- 1.4.2.3.1 The training of shore-side personnel, as specified in chapter 1.3, shall also include elements of security awareness.
- 1.4.2.3.2 Security awareness training should address the nature of security risks, recognizing security risks, methods to address and reduce risks and actions to be taken in the event of a security breach. It should include awareness of security plans (if appropriate, refer to 1.4.3) commensurate with the responsibilities of individuals and their part in implementing security plans.
- 1.4.2.3.3 Such training should be provided or verified upon employment in a position involving dangerous goods transport and should be periodically supplemented with retraining.
- 1.4.2.3.4 Records of all security training received should be kept by the employer and made available to the employee or competent authority, upon request. Records should be kept by the employer for a period of time established by the competent authority. It is through the assessment of these records that the competent authority may determine whether proper training has been taken by the individual (AMSA 2013).

The IMDG code does not provide any recommendations about the frequency for repeating the training. An exception is the US, where the competent authority requires employees to repeat the training every 3 years (AMSA 2013; BDG 2013; IMDG 2008).

ISPS code

In the SOLAS Chapter XI-2 and ISPS Code Parts A and B, Security requirements for ships, ports and the interface between may be distinguished (Fig. 1).

According to SOLAS Chapter XI-2 and the ISPS code, requirements for port facilities include:

- Port Security Plan (PSP). A Port Security Plan has to be developed and maintained in accordance with the Port Facility Security Assessment (PFSA). The plan has to make provisions for each of the three security levels addressed for port facilities. The plan addresses: measures to prevent unauthorized access in the port, measures to prevent introduction of illicit devices like weapons or other dangerous substances, procedures to

² IMDG code recommends that security awareness is provided but is not mandatory in the hazard training curriculum.

ensure security and evacuation of the facility, procedures to interface with ships' security activities, reporting of security incidents, procedure to audit the PSP, etc.

- Port Facility Security Officers (PFSO). A port security officer is supposed to be designated by each port facility. This person can be in charge of more than one port. The activities under the responsibility of the PFSO include: a security assessment of the port, development and maintenance of the port security plan (PSP), security inspections, enhancing awareness, ensuring proper training, coordinating security activities with the CSO and SSO, and with security services, ensuring standards for personnel, etc.
- Security Procedures. These procedures are enumerated in ISPS code part B. These are divided in terms of three security levels and include 1) monitoring and controlling access to ports' restricted areas, 2) handling of cargo, 3) deliveries of ships' stores, and 4) handling of unaccompanied baggage.

In SOLAS, Code Contracting Governments, three security levels are defined (Shiundu 2004):

- Security Level 1, *normal*.
- Security Level 2, *heightened*; lasting for the period of time when there is a heightened risk of a security incident.
- Security Level 3, *exceptional*; lasting for the period of time during which there is the probability of an imminent risk of a security incident.

The Port Facility Security Assessment is a tool at the disposal of PFSO to identify potential threats and vulnerabilities and update the PFSP accordingly. The Contracting Government or a recognized security organization is in charge to carry out the Port Facility Security Assessment (only the Contracting Government is responsible to review and approve compliance). To perform a PFSA, the following processes are undertaken (EC 2004) (Fig. 2):

1. Identification of critical assets and infrastructure. Identification and evaluation of important assets and infrastructure that need protection.
2. Threats identification. Identification of threats to assets and infrastructure identified above. In this process likelihood of occurrence is estimated.
3. Countermeasures identification. In view of the identified threats and likelihoods, countermeasures are identified, selected, and prioritized. Level of effectiveness of the countermeasures is also estimated in this step.
4. Identification of weaknesses. Weaknesses may include the human factors, policies, procedures, infrastructure, etc.

The PFSA has to be reviewed and updated, taking into account threats and/or minor/major changes in the port facility. In addition, all results of the PFSA have to be documented and recorded by producing a summary describing how the assessment was conducted, the vulnerabilities found, and a description of the countermeasures. This is documented in a Port Facility Security Plan (PFSP).

Main organizations and regulatory bodies

The main organizations working with port security matters may be grouped as follows:

- International Maritime Organization (IMO).

Fig. 2 Steps to perform a PFSA and develop the PFSP accordingly

- European Commission.
- Contracting governments and designated authorities.

International maritime organization (IMO) The International Maritime Organization has for years dedicated its work to improving safety and environmental conditions in the maritime environment. During the 1980s to 1990s an intensive security work was initiated through the Convention of Suppression of Unlawful Acts against the Safety of Maritime Navigation (Hesse 2002). This work was intensified in view of the growing piracy and armed robberies attacks, as well as the 2001 attacks in New York. In particular, as a first reaction to the terror attacks in New York, the IMO developed Chapter XI of SOLAS in 2004, enforcing the security requirements in the ISPS code.

It is due to the IMO's continual efforts that today the shipping industry is one of the most regulated in the world. The IMO's work covers many sectors, including protocols, codes, guidelines, recommended practices, circulars, etc. The IMO has also published on its homepage documents concerning statistical evidence of pirate attacks worldwide as well as circulars specifying recommendations for shipping industries to increase security on board (Kothari 2008).

European Commission Major efforts of the European Commission, in terms of maritime and more specifically port security, have concentrated on the development of regulations and directives in order to ensure dissemination and harmonized

application of security measures across all European port facilities and shipping companies. Relevant activities highlighted in this report are:

- EC Regulation (EC) No 725/2004
- Directive 2005/65/EC
- EC Regulation (EC) 324/2008

The European Commission has developed and enacted the *EC Regulation (EC) No 725/2004*, consisting of measures to enhance the security of ships through measures to be applied by port facilities in order to prevent intentional unlawful acts (including piracy and robbery at sea). In particular, the regulation aims to harmonize the interpretation and implementation adopted in the International Convention for the Safety of Life at Sea (SOLAS Convention) and established in the International Ship and Port Facility Security Code (ISPS Code part B) by the IMO (International Maritime Organization). Particular emphasis is given to the Port Facility Security Plan (SSP) and the role of the Port Facility Security Officer (PFSO) to guarantee that “adequate training has been provided to personnel responsible for the security of the port facility” (EC 2004).

In accordance with Article 11 of the Regulation, the MARitime SEcurity Committee (MARSEC) has been established, having the main role to support mutual exchange between Member States of best practices, indications on national instructions, sensitive information (i.e. security levels adopted, threat evaluations, and other topics relevant for maritime security) (EC 2004).

Each Member State shall communicate to IMO, the Commission and the other Member States information about the special measures to enhance maritime security of the SOLAS Convention (Fig. 3). Other information needs to be communicated only to the Commission and other Member States: list of port facilities’ security assessments and contact details of officials in charge as well as details of ships expelled from or refused entry to a Community port (EC 2004).

The regulation states that each Member State is in charge to issue a national programme to implement the regulation as well as to carry out the administrative and control tasks required by the SOLAS Convention and ISPS code. Thereafter, the Commission shall start inspections of a selected sample of port facilities and

Fig. 3 Communication exchange from Member States to IMO, Commission, and other Member States

companies. The reports of the inspections are then communicated to the concerned Member State with details about improving any shortcomings. Thereafter the Member State should report the remedies taken to the Commission (within 3 months).

The directive 2005/65/EC on enhancing port security is linked to Regulation No 725/2004. It ensures that security measures are applied to all ports within a perimeter defined by the competent Member State. In particular, these measures refer to (EC 2005):

1. Common basic rules on port security measures. These basic measures should apply to all ports located in the territory of EU Member States covered by an approved Port Security Plan according to EC regulation No. 725/2004.
2. An implementation mechanism for these rules. Mechanisms for implementing the measures stated in EC Regulation (EC) No 725/2004 and consequently checking their conformity.
3. Appropriate compliance-monitoring mechanisms.

The EC Regulation (EC) 324/2008, on procedures for conducting inspections in the field of maritime security was adopted in 2008 and consists of procedures to monitor the Member States' application of the European legislation on port security at the level of Member States. According to the regulation, inspections are conducted by the Commission to verify the effectiveness of the national quality control systems and to ultimately ensure the security of the individual port facilities and relevant companies. The European Maritime Safety Agency (EMSA) actively participates at these inspections and provides technical assistance to the Commission. This regulation was adopted in 2008 and consists of numerous procedures (EC 2008).

Contracting governments and national authorities As specified in the previous section, European contracting governments have a central role to ensure that EU regulations and directives are implemented at the national level. Activities to be carried out are specified in SOLAS chapter XI-2 and ISPS code Part A, and include:

- Set an appropriate national security level from 1 to 3, respectively: 1 - normal, 2 - heightened and 3 - exceptional.
- Designate the national authority (designated authority) that is responsible to undertake security duties related to port and ships as indicated in SOLAS Chapter XI-2 and ISPS Code. The designated authority may delegate a Recognized Security Organization (RSO) to carry out security duties indicated here. However, approval decisions are exclusively taken by the designated authority.
- Approve a Ship Security Plan (SSP).
- Verify compliance of ships to SOLAS Chapter XI-2 and ISPS code part A and issue an International Ship Security Certificate.
- Determine which port facilities require a PFSA and who will be responsible for the production of the PFSA.
- Ensure completion and approve the PFSA.
- Approve the PFSA.
- Exercise control and compliance measures.
- Test approved plans.
- Communicate with IMO as well as with shipping and port industries.

Port and ship security assessment need to be continuously reviewed and verified by the designated authority or the Recognized Security Organization. Parts of the requirements of the PFSP or SSP include training drills and exercises. Hence, these are controlled and verified by the authority and RSO (Fig. 4).

Education and training in port facilities

The ISPS Code Part A (art. 18.1) points out the importance to provide specialist education to port facility security personnel. This comprehensive education should include training, drills, and exercises.

Training The ISPS code part B defines three sets of training content for personnel in port facilities: PFSO, personnel with special security duties, and all personnel working in port facilities. The PFSO should receive more knowledge and training in port security. His/her knowledge should cover about 20 areas related to port security (EC 2004):

- Security administration;
- Relevant international conventions, codes, and recommendations;
- Relevant government legislation and regulations;
- Responsibilities and functions of other security organisations;
- Methodology of port facility security assessment;
- Methods of ship and port facility security surveys and inspections;
- Ship and port operations and conditions;
- Ship and port facility security measures;
- Emergency preparedness and response and contingency planning;

Fig. 4 Roles of contracting governments, designated authorities, and recognized security organizations (*applies only to the designated authority)

- Instruction techniques for security training and education, including security measures and procedures;
- Handling sensitive security-related information and security-related communications;
- Knowledge of current security threats and patterns;
- Recognition and detection of weapons, dangerous substances, and devices;
- Recognition, on a non-discriminatory basis, of characteristics and behavioural patterns of persons who are likely to threaten the security;
- Techniques used to circumvent security measures;
- Security equipment and systems, and their operational limitations;
- Methods of conducting audits, inspection, control, and monitoring;
- Methods of physical searches and non-intrusive inspections;
- Security drills and exercises, including drills and exercises with ships; and
- Assessment of security drills and exercises.

Other personnel, working in port facilities with special security duties, should have knowledge and receive security training in about 10 topics (EC 2004):

- Knowledge of current security threats and patterns;
- Recognition and detection of weapons, dangerous substances, and devices;
- Recognition of characteristics and behavioural patterns of persons who are likely to threaten security;
- Techniques used to circumvent security measures;
- Crowd management and control techniques;
- Security-related communications;
- Operations of security equipment and systems;
- Testing, calibration, and maintenance of security equipment and systems;
- Inspection, control, and monitoring techniques; and
- Methods of physical searches of persons, personal effects, baggage, cargo, and ship's stores.

Finally, all personnel working in port facilities should have knowledge of about 4 main topics (EC 2004):

- The meaning and the consequential requirements of the different security levels;
- Recognition and detection of weapons, dangerous substances, and devices;
- Recognition of characteristics and behavioural patterns of persons who are likely to threaten the security; and
- Techniques used to circumvent security measures.

Drills and exercises Drills and exercises in port facilities are recommended in ISPS code Part B to ensure that port facility personnel is 1) proficient in all security activities and 2) able to identify all deficiencies that need to be addressed. Drills have to be conducted every 3 months. Exercises should be conducted once a year with no more than 18 months in between. CSOs and SSOs should be required to join the exercises. Types of exercise could be: 1) full-scale, 2) live simulation or seminars, and 3) combined with other Port State Authority exercises (EC 2004).

Techniques for harmonized education and training

Existing research has proven the relationship between education and global economy and technology, respectively. Changes of economy and technology create new occupational structures and skill profiles that need to be fulfilled when students enter the labour market or when working professionals need to deal with a changed environment (Brown and Duguid 2000). Hence, education has the main role to fill some gaps by:

1. Monitoring changes in economies and technologies,
2. Tailoring training and educational courses accordingly, and finally
3. Ensuring that new workforce will have the proper level of skills, abilities, and competences (Guile 2001).

It is within this context that the Lifelong Learning (LL) as well as Vocational Education and Training (VET) concepts have been developed. The main vision of lifelong learning concerns placing learning activities at the heart of economic development. This implies that adult learning must follow worldwide developments and ensure that individuals are updated about all recent advances achieved within their professions (Quintino et al. 2011). This concept praises the commitment of individuals to become lifelong learners, i.e. to ensure that learning is performed throughout all stages of the life of an individual. Vocational Education and Training (VET) builds upon lifelong learning by putting more emphasis on the practical preparation of people to specific careers. Hence, training courses are usually based on manual and practical activities aiming at putting theories into practice and thereafter facilitating the approach of students to the working world.

Current research, focusing on the issue of harmonizing training and education in EU countries, has pointed out the issue of dealing with different requirements, education content, education systems, and approaches to lifelong learning (LLL) or vocational education and training (VET). This issue becomes more tangible when free mobility of workers is impeded due to lack of mutual recognition of education and qualification systems in EU countries.

This problem has already been addressed in the welding industry sector, where there was a lack of harmonized education and qualification systems across the EU as well as an impediment to free mobility of workers, mainly due to different cultural social and organizational issues in different EU countries. To overcome this challenge it was decided to develop a qualification and certification system that could enable mutual recognition of courses and certificates in the EU. More specifically, three main steps may be identified (Quintino et al. 2011):

- Design EU common courses. This may be accomplished by defining course syllabi at the EU level, indicating main subjects and accordingly:
 - Objectives
 - Scopes
 - Expected Results
 - Minimum hours of teaching
 - Rules and procedures for implementation of education, examination, and qualification
 - Targeted audience, i.e. “learners” (e.g. technicians, engineers, specialists, etc.), inspectors and all other relevant entities

- Development of a harmonized Quality Assurance System:
 - Establishment of a national authority in charge of the supervision of the system training, qualification, and certification of personnel in each country
 - Creation of a group of lead assessors and peer assessors in charge to audit the conformity of national authorities
 - Creation of training bodies and definition of standard requirements. The national authority should approve the training body
 - Assurance that certification is according to EN and ISO standards
- Distance learning. This implies the following activities:
 - Translation of courses in different languages,
 - Establishment of online platforms, and
 - Access and availability to EU students or professionals

Gaps in existing frameworks

A critical review of the existing frameworks presented in [Method](#) section of this paper allows highlighting some major concerns. Overall, it may be stated that clear and specific guidelines about how to standardize and harmonize training and education courses are missing. The EC Regulation (EC) No 725/2004 provides recommendation to facilitate the harmonization of the interpretation and implementation of security measures in EU port facilities. These recommendations cover the choice of security measures and the evaluation of security plans but also the development and evaluation of training, drills, and exercises; however we could not find any specific indications about how these objectives may be accomplished. More specific gaps that our team could spot are summarized in [Table 1](#) and may be categorized in three main areas:

- Design of EU common courses
- Quality assurance systems
- Distance Learning

Design of EU common courses The ISPS code indicates clearly a total set of 34 subjects or topics that are of interest for port personnel. Hence, it may be stated that these topics correspond well to subjects or modules required to develop a course syllabus, as suggested in [Quintino et al. \(2011\)](#). However, the lack of objectives, scopes, and expected results, stated at the EU level, generate much uncertainty about the real content that trainers are supposed to develop. Likewise, the lack of indications about 1) minimum hours of training and 2) rules and procedures for implementation of education, examination, and qualification, may be hypothesized as factors hindering the development of harmonized courses at the EU level.

Finally, the recommended targeted audience should include inspectors and other working profiles that are relevant for the specific sector, while the ISPS indicates only PFSOs, personnel with special security duties, and finally other personnel working in

Table 1 Comparison of steps required for harmonization and recommendations given in existing maritime security frameworks

	Harmonization steps	Maritime security frameworks
Design of EU Common Courses	Course syllabus and related subjects	Areas or topics relevant for port security training are indicated.
	Objectives	Absent
	Scopes	Absent
	Expected Results	Absent
	Minimum hours of teaching	Absent
	Rules and procedures for implementation of education, examination, and qualification.	Absent
	Targeted audience, i.e. “learners” (e.g. technicians, engineers, specialists, etc.), inspectors and all other relevant entities	Recommendations in existing frameworks identify three categories of audience in port facilities: 1. PFSO 2. Personnel with special security duties 3. All personnel in port facilities Other categories outside port facilities are not recommended as audience to target courses.
Quality Assurance System	Establishment of a national authority in charge of the supervision of the system training, qualification, and certification of personnel in each country.	Role of national authority is provided in generic terms in existing regulation (ISPS Code). However, nothing specific about supervision of training, qualification, and certification is indicated.
	Creation of a group of lead assessors and peer assessors in charge to audit the conformity of national authorities.	According to the ISPS code, the EU commission is entitled to perform inspections at port facilities. However, no specific instructions are provided in terms of training and education.
	Creation of training bodies and definition of standard requirements. The national authority should approve the training body.	No training bodies are recommended in existing frameworks. Overall, it is suggested that a Recognized Security Organization can explicate some of the functions of national authorities. In addition, no indications are given about standard requirements and criteria for selection of these organizations.
	Ensure certification according to EN and ISO standards.	EN or ISO standards for training are absent.
Distance learning	e-Platform	Absent
	Language translation	Absent
	Access/Availability at EU level	Absent

port facilities. Educating and training inspectors or instructors means that courses are kept updated, or likewise that those who evaluate have the right skills to perform assessment of instructors, training bodies or procedures for education, examination, and qualification. Educating other categories of “learners”, e.g. law enforcement

agencies, customs officers, or terminal operators located inside ports, means that other actors that interact with port facilities will have the same skills and competences of port personnel. This implies less misunderstanding, fewer delays, and more effective operations.

Quality assurance systems Comparing existing frameworks with the recommended procedures for the establishment of a harmonized quality assurance system (see paragraph 2.6), we find major differences. First of all, we could not find any specific recommendations about how to establish a national authority in charge of the supervision of the system training, qualification, and certification of personnel in each country. The ISPS code provides indications about the role of the national authority but in very generic terms, without giving any specific instructions about supervision of training, qualification, and certification.

Previous research in the education and training field also suggests the creation of a group of lead assessors and peer assessors that are in charge to audit the conformity of national authorities described above. Examining the ISPS code we found that the EU commission is entitled to perform inspections at port facilities. However, no details are provided to specify whether these inspections should cover activities related to training and education of port facility personnel.

Training bodies are also important factors that national authorities should approve and monitor. However, also in this case we could not find any particular recommendation in the ISPS code. The Recognized Security Organization is the concept that may be best associated to training bodies. According to the regulatory framework, contracting governments delegate national authorities that may delegate a Recognised Security Organization (RSO) that is in charge to control security plans of ships and ports as well as to audit and inspect. It is however unclear how the RSO is chosen and according to which standard requirements/certifications. The fear is that unclear instructions may lead port facilities to hire external consultants with questionable security expertise as well as lack of experience and knowledge of security requirements.

Finally, there is a lack of EN or ISO standards for training of personnel in port facilities. Such lack of standards is a clear obstacle to achieve a uniform education and training level in Europe.

Distance learning Distance learning supported by on-line platforms, language translations, and guaranteed access at the EU level are indicated to be optimal tools to ensure harmonized education as well as to promote free mobility of workers in EU countries. Existing frameworks screened within this study do not provide any information and/or recommendation on this subject.

Conclusion

Existing maritime security regulatory frameworks provide excellent information about how to secure port facilities. Despite this, experts warn about the inadequacy of existing legal frameworks aiming to effectively combat maritime crime. The hypothesis raised in this paper is that too little information may be provided to stakeholders about how to practically

implement maritime security training regulations. This ultimately results in different interpretations, lack of harmonization of courses across different countries, and finally degradation of security, as well as lack of commitment and engagement of personnel.

The EC Regulation (EC) No 725/2004 promotes the harmonization of the interpretation and implementation of security measures in port facilities, as specified in the ISPS code part A and B. These measures include also assessment and evaluation of training drills and exercises. However, we could not find any specific indications about how these activities may be standardized at the EU level. After benchmarking main education and training concepts such as Lifelong Learning, Vocational Education and Training, as well as previous experience focusing on harmonization work of courses and qualification systems in Europe, we are able to pinpoint some fundamental lapses in the maritime security frameworks:

- Lack of definition, at EU level of:
 - Objectives, scope, expected results of courses.
 - Minimum hours of teaching.
 - Recommendations of procedures and rules for implementing education, examination, and qualification.
- Lack of:
 - Recommendations to establish a national authority in charge to evaluate and assess training activities, nominate inspectors, and qualify training bodies.
 - Recommendations to monitor and control activities of national authorities in the EU as indicated above.
 - Recommendations to create training bodies and related standard requirements for approval of national authorities.
 - EN or ISO standards.

Hence, the examination of existing regulatory frameworks indicates that procedures to develop, monitor, and control training activities in the EU are unclear. This deficiency may affect harmonization, degrade commitment and engagement in security training, and ultimately security in port facilities. If this situation is not corrected, the risk for having weak points in EU ports increases and with it the possibility that these weak points could be used by criminals or terrorists to perpetrate their illicit activities. This study shows also, at a conceptual level, that harmonization of education and training could be easily built by benchmarking with the experience of other job markets (e.g. welding sector), where such objectives as harmonized education and quality assurance systems and the establishment of e-learning platforms have been successfully achieved. Hence, managers of port facilities as well as regulatory bodies are recommended to strengthen their collaboration to establish and agree upon a similar system that is able to harmonize security training in port facilities in the EU. Examining previous research we found that diverse studies have been performed to determine basic requirements for harmonized training and education at the EU level. However, none of these studies target security training and education in port facilities. By benchmarking existing recommendations for training with previous research, we found that much work remains to be done to establish a harmonized system in Europe.

The major limitation of this work is that many of the findings presented are based on the subjective interpretations of the authors. There is a substantial lack of primary

data that could be used to prove that just shifting previous experience from other working sectors will automatically benefit security training in port facilities. Likewise, in this study we explore the harmonization concept only in relation to port security training, and we do not discuss implications for ship security training or even the harmonization of security measures, like routines and technologies. Hence, we recommend that future research should aim to explore some of the ideas developed in this paper even for ship security and/or security measures in the maritime sector. Likewise, more research could be developed to determine whether there could be other factors that should be taken into account when it comes to harmonizing security training in ports. For instance, we believe that different threats, cultures, and contexts of different EU countries may affect the content of courses. Finally, interesting research could also focus on exploring the interrelationship between security training with the level of engagement and commitment in port facilities.

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