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CONSIDERATIONS ON QUALITY MANAGEMENT IN LOGISTICS CHAIN

Review Article

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Abstract

This paper deals with the issue of quality in the supply chain and the effects that it has on company performance. There are highlighted specific aspects of quality management in services and methodologies for quality improvement in this kind of activities. The paper presents the main components of quality management in supply chain, general standards applicable to companies in the logistics sector and, in particular, specific standards for the transportation field. It also revealed, the current use of quality management systems in Romania in companies operating in the logistics sector, as well as the quality assessment and quantification procedures in the supply chain.

INTRODUCTION

Quality is a concept that, over time, has been analyzed by many authors, generating numerous interpretations depending on the analyzed field, various periods of economic, technological, growth, but also the development of the society. Therefore, management of issues related to achieving quality standards in accordance with these has generated a considerably higher number of interpretations, approaches, proposals for solutions. Quality management, thus, became a distinct field of research, covering practically all organizational spheres.

There is therefore a significant number of studies that treated quality problems in many types of organizations. Most of the studies can be found in the field of quality management in industrial enterprises where, there were, in fact, implemented the first solutions that aimed to increase product quality. Not incidentally, the first international standards in the field of quality used the term of product using this notion, only mentioning that it included the term service. If at the beginning quality improvement methods were product oriented, they have known, subsequently, process and human resource orientation

This paper deals with the issue of quality in the supply chain, while emphasizes the characteristics of quality management in the field of services. This study has started from the review of some books, academic journals, professional publications, similar studies, business journals and periodicals. It also revealed, the current use of quality management systems in Romania in companies operating in the logistics sector, based on data made public.

EVOLUTION OF QUALITY MANAGEMENT SYSTEMS

As regards the quality management systems, over time, there have been implemented in organizations a large variety of systems, some of them being the result of improvements, developments of the previous systems.

They were based on different methods of quality improvement: Kaizen, Taguchi methods, Zero Defects program, PDCA, Six Sigma, TQM, Lean Manufacturing, ISO and others (Table 1).

There are a considerable number of studies that investigated the relationship between quality management practices and the performance of organizations, identifying among the performance indicators also those related to the qualitative performance (Talib, Rahman & Quresha, 2010; Prajogo & Sohal, 2003).

Referring to relations between quality practices and qualitative performance, an empirical study conducted by Arumugan, Ooi and Fongand (2008) shows a partial correlation between them. But the results obtained in other studies are at least contradictory. On the one hand, there are studies that reveal a positive influence of implementation of quality management practices on quality performance (Flynn, Schroeder & Sakakibara, 1995; Phan, Abdallah & Matsui, 2011). On the other hand, there are studies that identify no significant relationship between them (Forker, Mendez & Hershauer, 1997)

If in 1997 the results of a study done by Forker et al. lead to the conclusion of inefficiency of the quality management practices on quality performance due to their focus on internal organizational practices. In 2011 Tse and Tan emphasized the fact that as the logistics channels are becoming increasingly complicated, the source of quality problems is beyond the scope of the organization, problems quality-related activity can be determined by any activity in supply chain: transportation, warehousing, packaging, handling, etc.

Contradictory results are put by some researchers on account of contingent factors, such as: size of the organization (Sila, 2007; Zhao, Yeung & Lee, 2004), industrial sector (Lai & Cheng, 2003), cultural and national particularities (Flynn & Saladin, 2006; Sila, 2007).

Haiju (2013) considers that the traditional quality management practices are not enough to lead to a high qualitative performance, which led to a new theory of management quality from the perspective of logistics channel SCQM (Supply Chain Quality Management).

SCQM concept was proposed in Robinson and Malhotra (2005) as "the formal coordination and integration of business processes involving all partner organizations in the supply channel to measure, analyze and continually improve products, services, and processes in order to create value and achieve satisfaction of intermediate and final customers in the marketplace ".

Such a orientation implies the involvement of supply chain partners (Foster & Ogden, 2008; Kannan & Tan, 2005). In this respect, it may reveal what Yeung (2008) emphasizes in his study, namely that the partnership is an effective method to improve quality.

Thus, it grows a new philosophy of quality management, researchers advocating for expanding treatment of quality management to the entire supply chain (Foster, 2008). Considered until recently as having divergent objectives, quality management and supply chain management have been treated separately, reason why literature is quite poor in studies on quality management in the supply, compared to the significant number of studies in the two areas of research.

But also, in terms of components SCQM, there are differences of views among researchers (Table 2).
Relative to this new approach, of quality management extended to the supply chain, Shin, Collier and Wilson (2000) revealed that it positively affects both the performance of suppliers and buyers. Also, several researchers have investigated the manner in which quality management increases performance of the supply chain (Flynn & Flynn, 2005; Dowlatshahi, 2011; Lin & Gibson, 2011).
Romano and Vinelli (2011) studied the relationship between supply chain management and quality management, revealing that a coordinated logistic channel has a greater ability to meet the quality requirements of customers.
Lai, Lau and Cheng (2004) present a ten-step approach to quality through a quality management system, based on the principle of achieving everything the first time every time, as a first step to continuously improve logistics processes. The authors highlight the factors that led to the adoption of quality management systems in logistics: raising awareness of the importance of quality, customer pressure, need to implement mechanisms to improve work processes. To these, there are added intensifying competition, increasing regulation and performance expectations from shippers.
Minahan (1998) reveals the reasons why there are differences between companies that provide services and industrial companies in the adoption of quality management systems. Among those stand out greater difficulty in measuring a service performed incorrectly compared with defective products. Also, quality management and ISO focused on issues related to products using specific metrics, while services require more subjective actions, which led to difficulty in translating these standards in the companies from logistics sector.

QUALITY MANAGEMENT IN LOGISTICS ACTIVITIES

A well-known approach to increase quality, that can be used by companies providing logistics services, is that of total quality management (TQM). It is focused on customer satisfaction, elimination of waste, continuous improvement and employee involvement and empowerment, its purpose being to radically transform the organization through progressive changes in attitudes, practices, structures and systems (Kenol, 2015). TQM is in addition to a set of practices, an integrated philosophy aimed at the "total customer satisfaction" and a closer relationship with suppliers (Powell, 1995). Implementation of such a system leads to an improvement in long-term financial performance (Hendricks & Singhal, 2001).

Also, the Six Sigma technique is a quality assurance program adopted by several large companies like Motorola, General Electric, etc. A lot of the organizations that have implemented this technique have found that it is profitable to expand its principles to the whole supply chain (Jiju & Banuelas, 2002). For example, Coronado and Anthony (2002) have identified eleven success factors for Six Sigma implementation in small and medium enterprises in the UK. Another study in Slovenia (Gosnik & Vujica-Herzog, 2010) identified the involvement and participation of management, staff training, organizational and cultural issues as the most important factors, factors that are found in the previous study.
Gupta (2004) highlights the critical factors in implementing such a system: procurement and suppliers management, sales and distribution, anticipating further importance given to extending these quality management systems throughout the logistics channel. Sarkar and Mohapatra (2006) believes that the weak performance of suppliers affects the entire channel, which makes the process of selecting suppliers to be a very important task in ensuring the quality and reduce costs.
It is well known that in the supply chain the selection of suppliers is very important in order to reduce costs. But the relationship with suppliers is considered also important in quality assurance. Many organizations have realized that in order to satisfy their customers, they should be ensured that their suppliers are equally involved as those in quality assurance (Russell & Taylor, 2009).
Thus many researchers have attributed particular importance to suppliers' selection using Data Envelopment Analysis (DEA) to measure their effectiveness (Braglia & Petroni, 2000; Liu et al., 2000; Sean, 2007). A number of other methods have been applied also to rank and select providers:

- Integration of analytic hierarchy process AHP and linear programming (Ghodsypour & O'Brien, 1998);
- Fuzzy extended analytic hierarchy process FEAHP (Chan & Kumar, 2007);
- Integration of analytical hierarchy process with multiobjective linear programming MOLP (Ting & Cho, 2008).

Lou, Liu, Zhou and Quan (2009) present the architecture of a quality management system based on cooperative distributed multi-agent system.
A number of studies suggest solutions to improve the quality by using different methods based on information technology:

- through web-based ERP system used to manage the supply chain (Tarantilis, Kiranoudis & Theodorakopouls, 2008);
- by integrating planning of processes and programming (Moon, Lee, Jeong & Yun, 2008).

Fernandes, Sampaio and Sameiro Carvalho (2014) present a conceptual model that reflects the

integration of supply chain management with quality management and the impact on company performance.
Gunasekaran and Ngai (2004) reveal that the supply chain performance is influenced by integration and management of information in supply chain, which supposes the implementation of information and communication technologies.
In terms of technology there are already means for implementation of an integrated quality management system throughout the supply, using cloud computing and SaaS (software-as-as-service). Partners can log in and enter data in the quality management system of the company, which allows for monitoring quality issues (Sparta Systems, 2014). Such a system offers the advantage of traceability, being possible to identify the sources of quality problems and solve them faster.
In Romania, in quality assurance, there is a national standardization body ASRO - Standardization Association in Romania, but companies can also opt for the certification according to European or international standards. Besides standardization and certification bodies there are also accreditation bodies and associations of accreditation bodies (Figure 1).
Majority of large companies operating in the sphere of logistics activities, in Romania, have opted for certification according to the Quality Management System ISO 9001: 2008. Some of them, especially multinational companies, have also other certifications such as TAPA (Transported Asset Protection Association Europe), SQAS (Safety and Quality Assessment Systems), EN ISO 14001/2004 (Quality and Environment), integrated management system implementing the requirements of several standards, not only that of the quality (quality / environment / occupational health / safety / product / HACCP - Hazard Analysis and Critical Control Points).
Regarding the ISO standards, which have a wide applicability in transportation and logistics companies, most of them use general standards for the activities they carry out (Table 3).
Within the European and international standards we find also, for several years, standards for supply chain (Table 4) in order to evaluate the benefits of quality for various logistics services: transportation, packaging, labeling and storage.
Into the whole logistics activities, transportation of goods holds the top position, both in value and as number of transactions. The existence of several transport modes which are based on the diversified equipment and operating technologies, various issues raised by the realization of transport services, both in terms of technical, technological, safety and security of goods, vehicles and staff and in terms of trade and finance, have determined, in time, the development and implementation of specific standards for transports of goods (Table 5).
Islam and Zunder (2014) highlights the need for a new standard for freight transport and logistics in Europe. They define quality of logistics and freight transport as the extent to which performance of freight transport operations in the logistic channel meets the declared service criteria.

QUALITY ASSESSMENT AND QUANTIFICATION IN THE SUPPLY CHAIN

In order to assess the quality of logistics services it needs to be quantifiable. It is therefore necessary to identify and implement a system of specific indicators.
Quantification of quality of logistics services was in the center of concerns for many researchers. A first scale was presented by Bienstock, Mentzer and Bird (1997), namely, Physical Distribution Service Quality (PDSQ) that measure the quality from a technical point of view. Starting from the methodology used in this study, Mentzer, Flint and Kent (1999) have developed a new scale, Logistics Service Quality (LSQ), in order to measure the quality of logistics services adding also functional aspects of quality. They conceptualized the following constructs: Order Accuracy (OA), Order Quality (OQ) Order Condition (OC) Order Release Quantities (ORQ) Ordering Procedures (OP) Order Discrepancy Handling (ODH) Information Quality (IQ) Personnel Contact Quality (PCQ) and Timeliness (T).
Giovanis, Tomaras and Zondiros (2013) point out that retailers evaluate process elements of the LSQ by assessing procedural quality of suppliers, procedures for handling discrepancies and quality of information. Also, the quality of processes affects their perceptions regarding the quality of the result of transactions.
Fitzsmmons and Fitzsmmons (2006) showed five dimensions of quality of provided services: confidence in the service, reaction speed of provider, safety and assurance of service, provider's empathy and tangible elements
Cheng and Choy (2007), in a study on the quality management of shipping, have identified eight success factors of quality management and, on this basis, have identified 60 measuring indicators.
Wang, Bilegan, Crainic & Artiba (2014) present an overview of the performance indicators used in intermodal transport by barge, highlighting so as indicators for service quality: number of contracts, waiting times in intermodal terminals and other types of terminals, average response time, duration of intermodal services, handling in the intermodal terminals, waiting times at borders, containers transported on barges, the number of empty containers transported.
Matijošiusa, Vasiliauskasb, Vasilienė-Vasiliauskienė and Krasodomskisb (2015) analyzed

the following quality criteria of a transportation service that predetermine its competitiveness: price of transportation, safety, reliability, accessibility of services and duration of delivery. They highlighted also factors impacting key service quality criteria.
Quality control practices are common in companies providing logistics activities as a preventive measure to guard against problems that could lead to increased operating costs and effect on the company's image. This is because, in general, customers considered responsible the company from which bought the products. Whether the logistic service is perceived as being a high quality service, there are opportunities for customer loyalty for service. But this loyalty can be extended among the customers of the product, if the quality of the logistic service adds value to the sold product.
As already mentioned, one of the requirements for quality assurance is linked to the selection of suppliers. Failure in suppliers selection causes an increase in of the exposure to quality problems of companies, with negative effects on their reputation and, ultimately, on their profit.
For example, in the case of application of ISO 9001 in freight transport it is necessary to follow the way of obtaining customer satisfaction, possibility of improving processes and transport services, complying with the requirements of the provided service, but also the ability of suppliers to meet organization requirements.
Into Romanian companies operating in the logistics sector the most commonly used criteria in selecting suppliers are price, quality, on-time delivery, flexibility, geographic coverage, compliance with contracts.
In recent years, there have been taken into account other criteria such as additional services, responsiveness to customer requests and complaints, capacity of innovation, availability of equipment. In selection of suppliers there should be taken into account also criteria relating to quality:

- implementation of programs in order to increase quality;
- adoption of quality management systems;
- easy communication and good cooperation.

But a very few companies in the sector have implemented a system to monitor the performance of suppliers. Difficulties in the evaluation and comparison are determined by the large number of suppliers and the availability of disparate data sources.
In order to implement such a system is necessary to screen suppliers to be monitored, identifying a system of indicators to assess their performance, the method of collection and information management.

CONCLUSIONS

Quality of service has to exceed consumer expectations in order to services to be perceived as high quality. From their point of view there are important aspects such as compliance with program of deliveries, stock availability, product or service compliance, rapidity in solving requests.
Existence of some clear procedures on requirements of processes within each department, as well as employees' responsibilities in achieving them can help in increasing customer satisfaction.
Also, in the case of logistics services, it can be taken into consideration the need for compliance of some rules in providing services, according to some standards or specific rules. For example, in the case of rail transport, compliance of technological processes minimizes the duration of transport criterion taken into account in assessing the quality of service.
It is necessary to identify problems as early is possible in the supply chain, before the products reach customers. Many intermediaries in many of the supply chains make it difficult the withdrawal of goods from the market.
Globalization, the entry of companies into new markets, but also their relocation in regions other than those autochthonous or already considered traditional, led to the development of new organizational models adapted to the requirements of the new terms of business environment.
In managing quality issues, integrated solutions, extended to the entire supply chain are the solutions prefigured as the most suitable.

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FIGURES

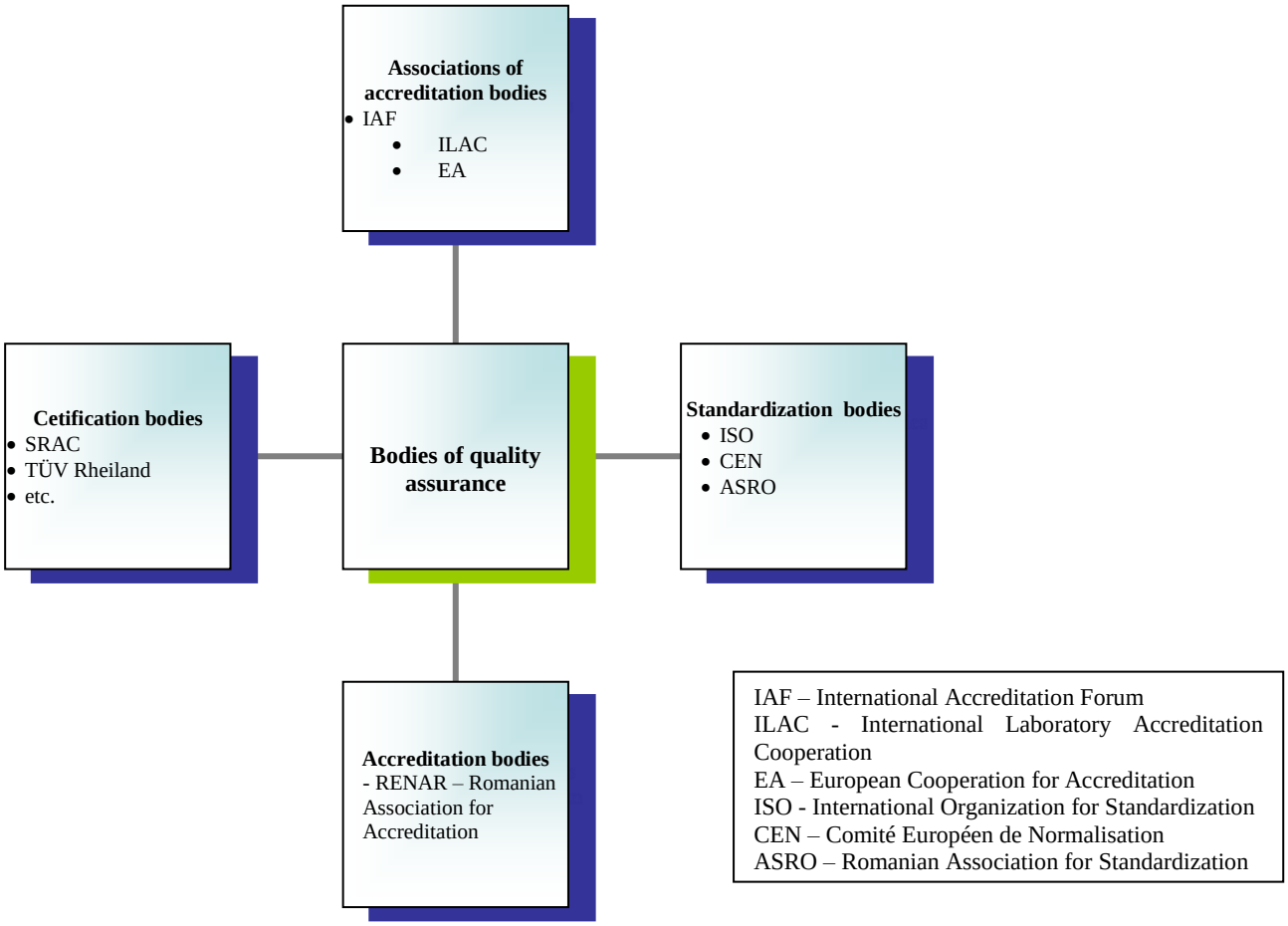

Figure No. 1. Bodies of quality assurance in Romania

TABLES

Table No.1
Quality Improvement Methodologies

Quality improvement methodologies		General characteristics
Kaizen		Continuous improvement
PDCA		Plan → Do → Check →Act cycle for quality control
Taguchi Methods / Robust Design		Statistical methods aimed at improving the fundamental function of the products or processes, taking into account environmental changes during the use of the products, their production and damage of components
Zero Defects Program		Reduction defects through prevention and application of motivational techniques
Quality Circle		Periodic reunions of employees performing the same types of activities, under the guidance of a supervisor in order to identify, analyze and find solutions to problems faced in their activities
QFD		Quality Function Deployment / Quality House – based on transformation of qualitative demands of the customers in quantitative parameters
TQM		Introduction awareness of quality in all processes of the organization
Six Sigma		• Use data, measurements and statistics to identify factors for increasing profits and customer satisfaction (Brue, 2006) • Error rate 3.4 to 1,000,000 served customers • Methodology proactive rather than reactive, focused on modifying and improving processes, ensuring that there are fewer errors and defects (Harry & Schroeder, 2000)
ISO 9000	9001: 2015	• Use the approach process, which include PDCA cycle and risk-based concept; • The quality management principles are: customer focus; leadership; engagement of people; process approach; improvement; evidence-based decision making; relationship management (www.iso.org)
	9004: 2009	• focuses on how to make a quality management system more efficient and effective
	19011: 2011	• sets out guidance on internal and external audits of quality management systems
Lean Manufacturing		• efficiency, eliminating waste, productivity, maximizing output; • minimizing the complexity of the organizational structure

Table No.2
Components of quality management in supply chain

Potential components ale SCQM	*Authors*
Customer focus, quality practices, supplier relations, leadership, HR practices, business results, safety	Foster (2008)
Externally focused process integration, management and strategy, communication and partnership, supply chain quality leadership, quality and supply chain practices	Robinson and Malhotra (2005)
Supplier selection, supplier development and supplier integration	Lo and Yeung (2006)
Focused on upstream quality management: supplier selection, supplier participation, supplier integration and decentralization of purchasing	Lo and Yeung (2006), Shin, Collier and Wilson, (2000), Zu and Kaynak, (2012)
Upstream quality management practices and organizational quality practices: supplier participation in product design and Kaizen projects/workshops, quality-orientated supplier selection, and quality management practices	Lin, Chow, Madu, Kuei and Yu, (2005)
Information architecture - enabler of supply chain quality control	Xu (2011)

Table No. 3
General standards applicable to companies in the logistics sector

General standards	Scope	
ISO 14001 : 2015	Environmental management systems—Requirements with guidance for use	
SR ISO / TR 10017: 2005	Guidance on statistical techniques for ISO 9001: 2000.	
ISO 19011	Guidelines for auditing management systems	
SR EN ISO/CEI 17021:2011	Conformity assessment. Requirements for bodies providing audit and certification of management systems	
ISO 9001:2015	Quality management systems – Requirements	
ISO 10001 : 2007	Quality management — Customer satisfaction - Guidelines	Codes of conduct for organizations
ISO 10002 : 2014		Complaints handling in organizations
ISO 10003 : 2007		Dispute resolution external to organizations
ISO 10004 : 2012		Monitoring and measuring
ISO 10008 : 2013		Business-to-consumer electronic commerce transactions
ISO 10005 : 2005	Quality management systems - Guidelines	Quality plans
ISO 10006 : 2003		Quality management in projects
ISO 10007 : 2003		Configuration management
ISO 10012 : 2003	Measurement management systems — Requirements for measurement processes and measuring equipment	
ISO/TR 10013: 2001	Guidelines for quality management system documentation	
ISO 10014 : 2006	Quality management - Guidelines	Realizing financial and economic benefits
ISO 10015 : 1999		Training
ISO 10018 : 2012		People involvement and competence
ISO 10019 : 2005	Guidelines for the selection of quality management system consultants and use of their services	
ISO 31000 : 2009	Risk management — Principles and guidelines	
ISO 37500	Guidance on outsourcing	

Table No. 4
Specific standards for supply chain

Specific standards for supply chain	Scope	
ISO 28000:2007; ISO 28004-1:2007; ISO 28003:2007; ISO 28001:2007; ISO 28002: 2011; ISO 28004-2:2014; ISO 28004-4:2014; ISO 28005-2:2011; ISO 28005-1:2013; ISO 28004-3:2014	Security management systems for supply chain	
EN 15696 CEN 2008	Self storage - Specification for self storage services	
ISO 17365:2013	Supply chain applications of RFID	Transport units
ISO 17366:2013		Product packaging
ISO 17367:2013		Product tagging
ISO 17363:2013		Freight containers
ISO 17364:2013		Returnable transport items (RTIs) and returnable packaging items (RPIs)
ISO 16106:2006	Packaging -- Transport packages for dangerous goods -- Dangerous goods packagings, intermediate bulk containers (IBCs) and large packagings -- Guidelines for the application of ISO 9001	
ISO/TS 22318:2015	Societal security -- Business continuity management systems -- Guidelines for supply chain continuity	
ISO 18495-1:2016	Intelligent transport systems -- Commercial freight -- Automotive visibility in the distribution supply chain -- Part 1: Architecture and data definitions	
ISO/IEC TR 24729-1:2008	Information technology -- Radio frequency identification for item management -- Implementation guidelines -- Part 1: RFID-enabled	

	labels and packaging supporting ISO/IEC 18000-6C
ISO 28219:2009	Packaging -- Labelling and direct product marking with linear bar code and two-dimensional symbols
ISO/TS 16949:2009	Quality management systems -- Particular requirements for the application of ISO 9001:2008 for automotive production and relevant service part organizations

Table No. 5
Specific standards for freight transportation

Specific standards for transport	**Scope**	
EN 13011 CEN 2000	Transportation services	Good transport chains - System for declaration of performance conditions
EN 12507 EN – CEN 2005		Guidance notes on the application of EN ISO 9001:2000 to the road transportation, storage, distribution and railway goods industries.
EN 14943 CEN 2005		Logistics - Glossary of terms
CEN/TR 14310 CEN 2002	Freight transportation services - Declaration and reporting of environmental performance in freight transport chains	
EN 13876 CEN 2002	Transport - Logistics and Services - Goods transport chains - Code of practice for the provision of cargo transport services	
EN 12798 CEN 2007	Transport Quality Management System - Road, Rail and Inland navigation transport – Quality management system requirements to supplement EN ISO 9001 for the transport of dangerous goods with regard to safety	
EN 16258:2012	Methodology for calculation and declaration of energy consumption and GHG emissions of transport services (freight and passengers)	
Regulation CE 725/2004	Security of ships and port facilities	