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Abstract

Purpose – Seaborne trade accounts for 90 per cent of world's total trade activity. Ship management is a highly skilled discipline with a high degree of complexity yet it has failed to follow with the same pace the advancements of performance measurement systems (PMSs) like other industries. Business performance measurement has only recently become a relevant topic in shipping. The purpose of this paper is to evaluate the adoption of PMS in the shipping industry.

Design/methodology/approach – A questionnaire was developed based on the performance measurement literature and submitted to 100 shipping companies around the world obtaining 41 usable questionnaires covering 13 countries from Europe, Asia and America.

Findings – The adoption of performance measurement differs based on type of business: liquid bulk (tanker) vessels and bulk carriers or containers. Quality and safety management systems have fostered the adoption of performance measurement positively in tankers impacting decision making and the performance of shipping companies using PMS.

Research limitations/implications – While the sample is representative of the situation of the industry, it represents the results of one point in time.

Practical implications – The use of PMSs can be a tool to achieve superior performance but it may be fostered by, and has to be aligned with the needs of, internal and external stakeholders. Early adopters in the shipping industry are among the leaders in the industry.

Originality/value – The paper is a unique contribution to performance measurement since it explores the adoption of PMSs and its impact in performance at industry level in a global industry.

Keywords Company performance, Competitive advantage, Performance measurement systems, Shipping industry

Paper type Research paper

1. Introduction

The implementation of performance measurement system (PMS) is a key issue that every organisation must continuously pay attention to ensure its survival in environments that are changing constantly and this is one of the reasons PMS is a field in continuous growth (Marr and Schiuma, 2003). However, there is no coherent or unique body of knowledge about the type of PMS that will support organisations. Although there is a prevalent use of the balanced scorecard (BSC) (Kaplan and Norton, 1996; Rigby and Bilodeau, 2009), there are also a large number of performance measurement frameworks available (Marr and Schiuma, 2003) that have multiple dimensions and interpretations (Franco-Santos *et al.*, 2007). Moreover, there is a considerable discrepancy in the adoption rates of different PMS which generates questions about the contribution of PMS to business performance (Tung *et al.*, 2011). Bourne *et al.* (2000) found studies on the impact of performance measurement on business performance obtained contradictory findings.

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Bourne *et al.* (2007) stated that understanding the impact will only develop over a number of studies using different techniques in diverse contexts, e.g. industries, and using different approaches to performance measurement.

This study contributes to the PMS literature by exploring the adoption of PMS and the impact of PMS on company performance at industry level, an area still under development as indicated by Bourne *et al.* (2007), in a very special industry: the shipping industry. The shipping industry has been very slow on adopting PMS (Konsta and Plomaritou, 2012) primarily due to the absence of a unique framework that takes into account the particularities of this industry. The situation has somewhat improved with the compulsory introduction of the International Safety Management (ISM) Code (Rodriguez and Campbell Hubbard, 2005) and the voluntary wide spreading of the ISO 9000 series management system in the 1990s. One relatively recent example of a measurement system in the shipping industry is Tanker Management Self-Assessment (TMSA) (OCIMF, 2004) but it only applies to the tanker (wet) sector of the industry. Thus, this study investigates the extent to which PMS is widely adopted in the shipping industry and its potential impact on business performance.

The paper is organised as follows: in the literature review, we first discuss the relevance of studying the adoption of PMS within the context of the adoption of management innovations. Then, we introduce a review of the shipping industry to understand their operational requirements that make the industry a special case, we then discuss the various strategies available in the shipping industry and further, the linkage between PMS and company performance as it is one of our research objectives. Finally we present the PMS frameworks available in the shipping industry. The methodology employed to collect data and the results of our survey are presented afterwards. In the concluding section we discuss contributions for the performance measurement literature.

2. Literature review

The literature focusing on the adoption of management practices across firms varies from diffusion over space and time (Abrahamson and Fairchild, 1999) to the dynamics of "management fads" (Abrahamson, 1991). The literature suggest diverse drivers fostering the adoption of management practices: institutional conditions (Abrahamson and Fairchild, 1999), the market for new management practices driven by suppliers (Clark, 2004) and the attributes of managers (Gill and Whittle, 1993). However, the literature offers very little evidence on the relationship between the introduction of management practices and business performance (Mol and Birkinshaw, 2009), especially in the area of PMS (Tung *et al.*, 2011). In this section, we review the aspects related to adoption of PMS in general and then the particular conditions of the shipping industry affecting its level of adoption.

2.1 Strategy and PMSs

The implementation of an effective and relevant PMS is a fundamental issue that every organisation must continuously pay attention to in order to ensure its survival and direct its strategy in macro and microenvironments that are changing constantly (Kunc and Bhandari, 2011). Kunc and Bhandari (2011) also suggest the attention of firms towards key success factors in their industries and their strategies affect the design and use of PMSs. The organisation's PMS needs to be linked to its business and operational strategy because it will help to keep track the organisation's direction,

maintain a competitive position and reveal the links between goals, strategy, lagging and leading indicators (Kaplan and Norton, 1996; Nanni *et al.*, 1992). Neely *et al.* (1994) argue that one of the key factors for the alignment between strategy and PMS is the consistency of both decision making and action. Their study concludes that those who achieve consistency, or alignment, compete on quality as opposed to those who compete on price, who lack consistency. To achieve this alignment, there must be a broader approach to adopting, devising and using performance measures. Metrics of pure financial orientation cannot interpret and be meaningful in dynamic and complex sequence of events. Measures developed outside the actual strategic context will not be able to drive the results called by the strategy. For example, adopting PMS due to regulations may mislead the focus of attention of the companies impacting in their performance. By aligning measurement to strategy, leaders can identify and implement measures in the context of where a business is heading. Additionally, when managers understand the linkages between performance measures and strategic objectives, strategically linked measures will have greater impact than common financial measures on performance (Kunc, 2008).

Thus, researchers suggest a positive correlation between the adoption of performance measurement and successful implementation of strategy. For example, Melnyk *et al.* (2004) argue that strategy without PMSs is not possible to implement and PMSs without strategy is managing an organisation without direction. Thus, the role of PMSs is recognised and is not only limited in monitoring and control, but it also provides useful information and feedback for the development of new strategic initiatives within the greater strategic development process (Kunc and Bhandari, 2011). By aligning the chosen strategies of the company with its PMS, the firm can achieve superior performance.

Indeed researchers have already explored such questions as how PMS align a firm's strategy and how these systems can be developed and deployed in industries (Neely *et al.*, 1996; Bourne *et al.*, 2000) but there is contradictory evidence on their adoption and impact on business performance (Tung *et al.*, 2011). Most of the literature asserts that PMS are the result of an endogenous process of selection the performance measures aligned with strategy but there is less evidence on its impact when the process is exogenous, for example driven by institutional conditions (Abrahamson and Fairchild, 1999) or the market for new management practices (Clark, 2004). This is one of our main motivations for our study. An additional motivation is the existence of a large number of performance measurement frameworks available, e.g. Performance Prism, Gap Analysis, BSC, Key Performance Indicators (KPI) (Marr and Schiuma, 2003), making it more difficult to identify the impact of PMS frameworks on firm performance.

2.2 Characteristics of the shipping industry

Almost 90 per cent of world trade is carried by the international shipping industry (International Maritime Organization (IMO), 2012). Without shipping the import and export of goods such as oil, gas, merchandise, grains, iron ore, coal, etc. would not be possible or would be extremely expensive. Modern commercial ships are extremely sophisticated and considered a high value asset that can cost up to US$200 m to build. Merchant ships can be grouped in the following categories with each category of ship coming in a variety of sizes: oil/chemical/LNG tankers; ore/bulk carriers; container ships; other/general cargo (reefer ships, specialised cargo, fishing, etc.) and passenger ships. There are 47,122 seagoing commercial ships in operation of 1,000 gross tonnage (GT) and above (United Nations Conference on Trade and Development, 2013), with

a combined tonnage of 1.63 billion deadweight (dwt). Oil tankers accounted for 491 million dwt, bulk carriers for 685 million dwt, container ships for 207 million dwt and general cargo fleet stood at 80 million dwt. The world shipping industry has quadrupled from just over 8,000 billion tonne-miles in 1968 to over 47,000 billion tonne-miles in 2013. However, it is still an industry dominated by private firms operating globally.

The shipping industry has some characteristics which make it different from other land-based industries:

- It is a capital-intensive industry that requires large investments for entry but also high cash reserves for running and maintaining the ships (Stopford, 1997).
- There is strong evidence that the freight market is cyclically related to the world economy cycles and reinforced by the time lag taken to adjust supply and demand of ships (Stopford, 2012). Thus, it is very difficult to run and maintain vessels during bad times but companies generate super profits at good times.
- The owner and the manager of ship is not always the same. Generally the owning companies are incorporated in "tax heaven" countries like Liberia and Cyprus while the management companies are located in the origin country of the owner of the ship such as Greece, Germany and Norway, etc. In addition, there is a distance between the company's premises and the production unit, which is the ship (Mitroussi and Marlow, 2012).
- Environmental, technological and legislative changes affect directly the industry. For example the International Maritime Organization has recently developed an international legislation to regulate discharges of ballast water and reduce the risk of introducing non-native species from ships' ballast water. To comply with this requirement, ships will have to be retrofitted with treatment plants that can cost up to US$1 m per ship with current prices.Ship management is a highly skilled discipline with high degree of complexity, which is not only attributed to industry-specific particularities but also to the operational activities (Branch, 2007) such as:
- Supervision of the maintenance of ship machinery. The process also includes surveys and repair work of the ship.
- Provide adequate crew for manning the ship.
- Arrange for loading and unloading of the cargo.
- Maintain approval certificates by independent bodies (classification societies, flag administrations).
- Negotiate and supply fuel, lube oil, stores, provisions, spares, etc.
- Arrange for insurance of the ship and deal with various claims related to insurance, salvage, shortage of cargo, etc.
- Pay all expenses related to the operation of the ship such as agents, tugs, etc.
- Collect the freight on behalf of the owners.
- Face externalities such as weather, strikes, political and navigational risks, e.g. piracy.

From a competitive strategy perspective, there are few studies explaining competitive aspects of the shipping industry. On the one hand, Yang (2010) using the resource-based

view approach analysed the competitive advantage of the Taiwanese flagged merchant fleet. Yang (2010) found that the main factors responsible for the competitive advantage in shipping include GT, freight quantity, customer service standards, number of vessels, deadweight tonnage, number of crewmen, cargo loading ratio, accuracy of sailing schedule, ship nationality and cargo transport volume, which are mainly asset-driven operational performance measures. On the other hand, Lorange (2001) argued shipping companies have to resist the standard impression that shipping markets are almost perfect competition, overly mature, where one would only compete by providing the lowest possible cost and they should push for new opportunities by investing on human capital as done in other industries. Lorange (2001) suggests shipping companies need to:

(1) Develop a strong ability to "see" new business opportunities, i.e. to identify new customer needs that the customer himself does not yet realise that he has.

(2) Develop a strong capability to "mobilize" its resources to go after such opportunities. Resources include finance but above all the best team of people, complemented by relevant technology.

There seems to be two main strategies in the shipping industry: companies focusing their attention to more creative types of strategies like advancing technologies (in shipbuilding, for example) and value-based driving markets, where value is added by intangible attributes like learning capabilities, relationship management and continuous improvement; or companies under a cost focus domain tend to follow more traditional approaches like rapid and aggressive expansion, cost cutting, etc. The implementation of any of both strategies will have implications on the selection of PMS (Kunc, 2008; Kunc and Bhandari, 2011).

To summarise, the shipping industry has a strong influence on world trade due to its impact in costs and logistics. Simultaneously it is a highly competitive, asset-intensive, cyclical industry with complex management processes affected by multiple issues that influence the adoption of common management techniques, such as PMS.

2.3 Performance measurement in the shipping industry

Merchant shipping is still considered as one of the most dangerous and most heavily regulated sectors among the world's greatest industries. Naturally performance measurement in shipping has evolved from various safety requirements, measures and regulations. It is common, after great shipping disasters, e.g. Titanic in 1914, new compulsory regulations to be imposed in shipping such as Safety of Life at Sea Convention and the implementation of ISM. The ISM Code was designed by IMO to provide a guide for ship managers to create their own programmes individually tailored to meet comprehensive international standards for safety and pollution prevention in the operation of ships. ISM Code and consequently ISO workmanship standards (from ISO 9000 and 14000 to the more recent 18000 and 50000 series) are today the core elements in maritime management systems (American Bureau of Shipping, 2012).

The adaptation of ISO quality standards in shipping business provides invaluable benefits with regard to the technical management of merchant fleet, and is also very useful for improving the service quality and enhancing charterer's satisfaction. Lagoudis *et al.* (2006) in their study found that from the 24 factors' attributes contributing to higher performance in ship management, the top positions were occupied mainly by factors that are attributed to quality. However, it has been argued

that the adoption of quality in shipping is more of a marketing tool aiming to be covered by a freight rate (Goulielmos *et al.*, 2008). In addition to the above, research has shown that shipping companies, through their various management control systems (like, ISM, ISO, TMSA, etc.) can enhance their operational performance (Triantafylli and Ballas, 2010) and naturally these management control systems contain forms of PMS.

However, the situation in the shipping industry is not uniform. One of the key segments, tankers, is highly regulated due to their associated risks. Regulations determined a different approach to ship management including a focus on quality systems and benchmarking. For example, TMSA is an approach based on the BSC customised for the tanker industry (Stavrakakis *et al.*, 2010). An initiative by the tanker industry, TMSA is a tool that can help the ship's operators/managers to measure and to improve their management systems. The TMSA is based on the concept of encouraging ship managers to achieve high standards of ship management and continuous improvement, by providing direction towards proposals of current best practice for the industry. The sequence of action, based on the TMSA, is plan-act-measure-improve, hence a system that relies heavily on the measurement and correction concept proposed by performance measurement theory. Furthermore TMSA provides feedback of information to various stakeholders (mainly charterers, but also investors and shareholders) about the effectiveness of the management system of the company (Goulielmos *et al.*, 2008). TMSA2 the latest version includes some 245 KPIs associated with best practice guidance (OCIMF, 2004).

It is evident, however, in recent research that, for example in Greece one of the major ship management countries, tanker companies are still struggling to incorporate performance measurement in their daily activities and that the implementation of such measures is still evolving (Konsta and Plomaritou, 2012). Naturally shipping companies are still experimenting with various PMS, e.g. KPI, Performance Prism, etc., especially in the absence of a common, uniform measurement system that will apply to all sectors of the shipping industry.

To summarise, there is a non-uniform adoption of PMS in the shipping industry which makes the industry an ideal setting to evaluate the adoption, use and impact of PMS on company performance. This offers an additional motivation for this study as the PMS is still evolving in this sector and there is a not an industry wide standard or a best practised framework and each company is deploying its own methods to harness the benefits of performance measurement. In addition, there seems to be a lead in the tanker sector of the industry, due to increased safety regulations, as opposed to the other types of fleets, therefore it is important to explore the adoption of PMS and measure its impact considering the differences between tanker and non-tanker managers.

3. Research methodology

In the PMS literature the majority of previous studies employed case study approach leaving a gap in the literature to empirically examine the association between PMS effectiveness and its adoption (Tung *et al.*, 2011). Moreover, the literature does not present systematic evidence of the adoption of PMS and its drivers in the shipping industry, which is a key industry in a globalised world.

This study employs a survey-based methodology, e.g. Kunc and Bhandari (2011) and Tung *et al.* (2011), as an exploratory tool to map out the situation in the shipping industry. An exploratory study was chosen because there is no empirically evidence on the extent of adoption of PMS in shipping compared with more mature industries in terms of adoption of PMS, such as the manufacturing industry (Tung *et al.*, 2011).

A questionnaire was distributed to 100 ship management companies based in a variety of countries (see Appendix 1 for detail). Each company was asked to return the questionnaire completed preferably by its manager responsible for the PMS or quality manager if there was no PMS implemented, given their strong involvement in regulatory compliance which is one of the main drivers of the adoption of PMS in the shipping industry. Only one questionnaire per company was received. The choice of the companies were based on: spread in various locations of the globe, not only Europe; smaller and bigger companies; operating diverse fleets (i.e. tankers, bulk carriers, containers, etc.) and; likeness to answer the survey. The questionnaire was validated with quality managers of five shipping companies, keen to the authors, before distribution in order to evaluate its structure and understanding of its contents (Kunc and Bhandari, 2011).

3.1 Questionnaire design and variables

The shipping industry is characterised for its secrecy since most of the companies are not publicly listed (IMO, 2012). Therefore, quantitative data are difficult to obtain so we employ categorical variables asking for subjective measures of performance (Dess and Robinson, 1984). Likert scales are often used in studies of attitudes, in which the raw scores are based on graded alternative responses to each of a series of questions (Everitt, 2001) so the companies can only be classified into groups of responses using this method limiting the use of traditional statistical analysis. The structure of the questionnaire (see Appendix 2 for a detail including the variables used) is:

- The first section (Questions 1.1-1.6) provides information related to each company such as operating location, the types of ships managed, the size and age of their fleet, the number of years that company is in operation as well as their ownership status (Lambertides and Louca, 2008), that will give an indication on the general characteristics of each company (Kunc and Bhandari, 2011).
- The second section (Questions 2.1 and 2.2) collects information on the performance measurement tools (Neely *et al.*, 2003) that the company is using and the number of years they have been employing them. A broad selection of performance measurement tools was offered because, as discussed in the literature, the performance measurement in shipping is a relatively young concept and it is still evolving (Konsta and Plomaritou, 2012).
- The third section (Question 3) is addressed only to those companies who have some form of performance measurement in their organisation (Kaplan and Norton, 1996). Questions use a five-point Likert-type scale and intend to measure the usefulness of PMSs in each organisation and their alignment with the strategy of the company (Neely *et al.*, 1994; Jusoh and Parnell, 2008). Scale reliability has been measured for internal consistency using Cronbach's α coefficient (Cortina, 1993) with a value of 0.774.
- The final section (Question 4) is addressed to all participants in order to categorise their perception of the company's performance relative to the shipping industry (Kunc and Bhandari, 2011).

3.2 Description of the responses

Out of the 100 companies (see the list is in Appendix 1) that received the questionnaire, 65 returned it back either complete or incomplete. After screening of initial results,

24 were found to be incomplete leaving 41 complete questionnaires. This gives a response rate of 41 per cent, which is considered to be an average one by social science standards (Kunc and Bhandari, 2011). A broad description of the sample obtained is presented in Table I.

As shown on Table I, out of the 41 companies 16 were based in Greece (39 per cent). This over representation is normal since Greek companies dominate the shipping industry. The remaining 25 companies have good spread among traditional shipping centres: Norway (14.6 per cent); USA (7.3 per cent); Cyprus, Denmark, Germany, the Netherlands, Belgium and Singapore (29.4 per cent); and rest of the world (9.6 per cent). In total, 39 per cent of the respondents have been in business for over 30 years, 17 per cent between 20 and 30 years, and 15 per cent between ten and 20 years with only 29 per cent of the companies less than ten years. Only 29 per cent of the companies are listed publicly while the remaining companies are privately owned. The average age of the participating fleets is 10.4 years which is in the middle of the normal useful life of a ship.

Table II illustrates the fleet profiles. In all, 30 companies are managing only one type of vessel (i.e. liquid bulk, dry bulk, liner, passenger or other type of vessel) while 11 companies have multiple types of vessels under their management (hence the sum of companies in Table II is larger than 41). Almost half (21 out of 41) of the companies can be considered as tanker companies, i.e. having liquid bulk vessels under their management alone or with a combination with some other type of vessel.

Table I.
Characteristics of sample companies

Characteristics of sample companies	Count	% of total
Years in operation		
1-10	12	29.3
11-20	6	14.6
21-30	7	17.1
31+	16	39.0
Fleet size		
1-10	15	36.6
11-30	17	41.5
30+	9	22.0
Ownership		
Privately owned	29	70.7
Public listed	12	29.3
Location of company		
Belgium	2	4.9
Cyprus	2	4.9
Denmark	2	4.9
France	1	2.4
Germany	2	4.9
Greece	16	39.0
India	1	2.4
The Netherlands	2	4.9
Norway	6	14.6
Singapore	2	4.9
Sweden	1	2.4
Turkey	1	2.4
USA	3	7.3

Table III shows the classification of firms in terms of performance. Hi performers are the companies that belong to the top 10 and 25 per cent in the industry (i.e. the ones that are above average performance, 22 in total) while 19 companies are considered to be Lo performers. Table III also shows a clear alignment between performance and type of vessel. We can observe in Table IV that Hi performers are mainly tankers companies (43.9 per cent) while non-tankers are mostly in Lo performers category (39 per cent). Therefore, we will analyse the use and impact of PMS comparatively between tankers and non-tankers.

4. Results

Our first research objective is to evaluate the adoption of PMS in the shipping industry, Table V shows that only five, which are non-tankers, out of 41 companies have not adopted PMS, which is only 12 per cent. From these five companies, three stated that it is in their immediate plans to adopt a PMS while the other two do not have it in their plans. We can suggest performance measurement tools are widely adopted in shipping companies. However, there are discrepancies on the sophistication of the PMS adopted.

	Count	Table responses (%)	Table total, *n* (%)
Fleets managed			
Liquid bulk	21	35.6	51.2
Dry bulk	13	22.0	31.7
Liner	10	16.9	24.4
Passenger	7	11.9	17.1
Other	8	13.6	19.5

Table II. Types of ships managed

	Tanker/non-tanker companies					
	Non-tanker		Tanker		Total	
	Count	Column *n* (%)	Count	Column *n* (%)	Count	Column *n* (%)
Perceived performance						
In the lower 10%	0	0.0	0	0.0	0	0.0
In the lower 25%	2	10.0	0	0.0	2	4.9
Average	14	70.0	3	14.3	17	41.5
In the top 25%	3	15.0	10	47.6	13	31.7
In the top 10%	1	5.0	8	38.1	9	22.0

Table III. Perceived performance of sample companies

			Tanker/non-tanker companies		
			Non-tanker	Tanker	Total
Hi/Lo performers	Lo performers	Count	16	3	19
		% of total	39.0	7.3	46.3
	Hi performers	Count	4	18	22
		% of total	9.8	43.9	53.7
Total		Count	20	21	41
		% of total	48.8	51.2	100.0

Table IV. Hi/Lo performers × tanker/non-tanker companies cross-tabulation

	Non-tanker		Tanker	
	Number of responses	% of total	Number of responses	% of total
Performance measurement tools				
Performance Indicators	10	30	4	8
Key Performance Indicators	11	33	20	40
Key Results Indicators	2	6	5	10
Balanced Scorecard	1	3	3	6
Gap Analysis	3	10	11	22
Shipping Key Performance Indicators	1	3	6	12
Performance Prism	0	0	0	0
Other	0	0	1	2
None	5	15	0	0
Total Responses	33	100	50	100
	Number of companies	% of total	Number of companies	% of total
Years using performance measurement tools				
Not using	5	25	0	0
Not more than 5 years	8	40	5	24
5-10 years	6	30	9	43
For more than 10 years	1	5	7	33
Total responses	20	100	21	100
Years in operation				
1-10	9	45	3	14.3
11-20	4	20	2	9.5
21-30	3	15	4	19.1
31+	4	20	12	57.1
Total responses	20	100	21	100

Table V.
Adoption of performance measurement tools in the shipping industry

Tanker companies are keen on adopting more sophisticated and integrated PMSs, e.g. KPI, Gap Analysis and Shipping KPI (Konsta and Plomaritou, 2012) as indicated in Table V, than non-tanker companies. Moreover, tankers have adopted PMS for longer period of time (76 per cent of the companies have used PMS for more than five years) than non-tankers (only 35 per cent). It seems that the extensive regulations in tankers forced companies to adopt more sophisticated PMSs but mostly focused on operational support. Interestingly, the adoption of the BSC is very low among all shipping companies even though the TMSA system is an approach based on the BSC, which indicates a focus of the PMS towards operational rather than strategic support. The experience with the use of PMS shows a clear trend towards the tankers as they are more experienced companies in the use of PMSs.

Table VI presents the perceived impact of the PMSs separated between tankers and non-tankers companies. In general, all companies agree with the usefulness of PMS in their organisations in terms of facilitating growth and achieving a competitive advantage, avoiding risks as well as enhancing social and environmental responsibilities, benchmarking, and supporting decision making and strategy implementation. However, there are some differences in the use of PMS for benchmarking and fulfilling their environmental responsibilities between non-tankers and tankers which may reflect the focus of the use of PMS. While tankers have adopted PMS due to TMSA requirements rather than business needs, tanker companies seem to be more satisfied than non-tanker with the use of PMS in supporting strategic decision making and organisational growth.

	Strongly disagree (%)	Disagree (%)	Neither agree nor disagree (%)	Agree (%)	Strongly agree (%)
Non-tanker					
PM has facilitated my organisation's growth	0.0	6.7	26.7	53.3	13.3
PM has protected my organisation from loss and excessive risk	0.0	6.7	20.0	53.3	20.0
PM has helped me benchmark my organisation with respect to the industry	0.0	0.0	33.3	53.3	13.3
PM has helped my organisation gain a competitive advantage over rivals	0.0	13.3	26.7	53.3	6.7
PM is used to enhance my organisation's social and environmental responsibility	6.7	0.0	33.3	53.3	6.7
PM is used for decision making and strategy implementation	6.7	0.0	6.7	73.3	13.3
Tanker					
PM has facilitated my organisation's growth	0.0	9.5	23.8	47.6	19.0
PM has protected my organisation from loss and excessive risk	0.0	4.8	14.3	52.4	28.6
PM has helped me benchmark my organisation with respect to the industry	0.0	0.0	9.5	42.9	47.6
PM has helped my organisation gain a competitive advantage over rivals	0.0	19.0	14.3	57.1	9.5
PM is used to enhance my organisation's social and environmental responsibility	0.0	9.5	14.3	57.1	19.0
PM is used for decision making and strategy implementation	0.0	4.8	9.5	57.1	28.6

Table VI. Usefulness of performance measurement tools in the shipping industry

A χ^2 test was performed to evaluate the relationship between the perception of impact of PMS and the performance of the company (Hi/Lo performer). In order to assess the perception of impact of PMS, companies were grouped in those who had at least two "Strongy agree" answers in the questions contained in Section 3 of the questionnaire and those who had none or just one. The results indicate a moderate association between the two groups $\chi^2(1) = 3.594$, $p = 0.058$. Therefore, our study marginally cannot confirm statistically the impact of PMSs and performance in the shipping industry even though there is qualitative evidence in the responses received.

5. Discussion

One important aspect of our research is to identify the drivers of the adoption of PMS. In contrast to other industries (Tung *et al.*, 2011), the adoption of PMSs in the shipping industry has originated from the imposition of certain safety requirements from regulatory bodies, e.g. ISM (Cooper and Phillips, 1995). Sometimes those requirements are generated from peer pressure, e.g. TMSA, a move towards "quality" shipping similar to other industries (Chang, 2006) or institutional conditions (Abrahamson and Fairchild, 1999). This behaviour clearly illustrates the principles in Kunc and Bhandari (2011) regarding the attention of firms towards key success factors in their industries, even regulatory factors, and its impact on the use of PMSs. Shipping firms only turned their attention to PMS when there was a failure, e.g. a major maritime accident such as

the Exxon Valdez oil spill in Alaska, or the requirement from the market, e.g. charters. Thus, the findings confirm that institutional conditions (Abrahamson and Fairchild, 1999) have strong influence on the adoption of management practices including the adoption of PMS. However, there are disparities in their levels of adoptions as observed in previous studies, e.g. Tung *et al.* (2011).

In terms of the adoption of specific multidimensional PMS (Tung *et al.*, 2011), it is surprising that no company have adopted Performance Prism (Neely *et al.*, 2002) given the strong implications of shipping on many stakeholders (port authorities, flag administrators, classification societies, local environmental bodies, direct and indirect customers, employees). Unlike the first generation of performance measurement and management frameworks like the BSC, the Performance Prism is holistic in orientation (Neely *et al.*, 2002). It does not assume that the only stakeholders that matter are the shareholders and customers. Instead, the Performance Prism encourages management to focus on the critical questions such as: who are our stakeholders and what do they want and need? Ship management companies with so many external stakeholders should have adopted this approach to address the needs of their stakeholders. However, ship management companies still come short on these aspects and fail to keep up with the developments in performance measurement including BSC, on the contrary with other land-based industries, as they may perceive PMS as impositions rather than tools to improve business performance, as our findings suggests.

We also obtained contradictory evidence on the impact of PMS on performance (Bourne *et al.*, 2000) since we observed the alignment between the use of PMS and superior performance at industry level is marginally above 0.05. Interestingly, the five companies that are not using PMSs have classified themselves as Lo performers. One argument obtained from one of these companies is the lack of predictability in the business and the environment, which sounds clearly tautological since the lack of measurement influences the perception of predictability of the businesses (Kunc and Bhandari, 2011). While the implementation of PMS in shipping companies are focused on the operational strategy (Nanni *et al.*, 1992), as it is traditional in mature industries driven by service commoditisation, such as the shipping industry (Yang, 2010), we can observe that PMS can also have an impact in mature, cost-focused industries since it aligns organisational efforts with strategic objectives (Kaplan and Norton, 1996; Kunc and Bhandari, 2011). Companies that have understood the use of PMS should show better performance throughout the industry even though the shipping industry strongly suffers of cyclical periods of low performance, which may hinder the perception of usefulness of PMS.

However, a novel contribution from our research and practical implication is that implementing and using PMS provides specific benefits for companies comprising direct, e.g. compliance with regulations and reducing risks, and indirect benefits, e.g. ability to benchmark and obtain competitive advantages in costs. For example, efforts are being made recently to reduce CO_2 emission from ships (Longva *et al.*, 2010). This can be achieved by implementing technical modifications and/or improvements from the building on ship's equipment such as the engines, propeller, hull, etc. In this respect and in order to measure and evaluate the performance of a fleet with regard to CO_2 emissions certain performance indicators have been developed with Ship Energy Efficiency Operational Indicator (EEOI) being the most notable one that IMO is promoting on a voluntary basis (International Maritime Organization (IMO), 2009). A performance indicator like EEOI can provide benefits to societies in the long run, which are not traditionally measured in financial-based PMSs, as it has already been

proven in the Baltic and North Sea where stringent emission regulations are in force (Jonson *et al.*, 2014). One other notable example is the struggle to reduce fuel costs on operating ships. The increase of fuel price in the recent years (coupled by world economy slow down and thus decreased freights) has led management companies to reduce the fuel costs as much as possible. Maersk, one of the largest ship operators, reported that by monitoring KPI it has increased its fleet's propulsion efficiency and saved 160,000 tonnes of fuel – amounting to a savings of $90 m – since 2009 (Environmental Leader, 2012). Therefore, we can infer that a widespread adoption of sophisticated PMS can have practical implications for companies and society over the long term.

6. Conclusions

The shipping industry is a complex industry with strong implications in the global trade. Transportation costs can significantly affect the development of emerging economies due to its impact in the cost of their products. Savings in the use of energy can have important implications in climate change and the cost of products at global scale. Therefore, the adoption of innovative management practices, such as PMS, that can improve efficiency in the shipping industry is paramount to foster and maintain global commerce and economic development of emerging economies.

In terms of the adoption of PMS, the relative and unsophisticated use of PMSs comes to a surprise given the scale and maturity of the industry. Shipping companies seem to be reactive to the pressures from the environment when they adopt diverse management tools including PMSs. However, early adopters of PMSs are today among the leaders in the industry. The heterogeneous adoption of PMSs helped us to explore the link between PMSs and performance.

Extensions of this study can include more in-depth research using case study research and longitudinal studies to evaluate the factors driving adoption of PMSs and the impact on company performance from a multidimensional and systemic perspective (Kunc, 2008). An additional area of study is to evaluate how tools can help managers to understand the linkages between performance measures and strategic objectives, such as strategic modelling (Kunc and Morecroft, 2007), as a way to facilitate the adoption of PMS.

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Appendix 1

Country	Company
Greece	A.M Nomikos
Turkey	Akmar
USA	Alaska Tanker Company
Greece	Alison Management
Greece	All seas
Greece	Alpha tankers
Greece	Arcadia
Greece	Avin
Germany	Beluga
Norway	Bergshav Mgmt.
Cyprus	Bernhard Schulte
France	Bourbon
Norway	Klovning Shipping
Sweden	Brostron
Greece	Ceres LNG
Norway	Chriship
Cyprus	Columbia
Denmark	Dannebrog
Belgium	Diamond
Greece	Eastmed
Norway	Eidesvik
Greece	Eletson
Greece	Empire navigation
Greece	E.S.T.
Greece	Equinox Maritime
Denmark	Erria
Canada	Fednav
The Netherlands	Feederlines
Finland	Finnlines
USA	Frontline
Sweden	Furetank
Greece	Gleamray
The Netherlands	Gms shipping
Greece	Golden Energy
Greece	Grace Management
Norway	Green Reefers
Greece	Gulf
Germany	Hapag Lloyd
Norway	Hoegh Autoliners
Norway	Ostenjo Rederi
Greece	Imperium
USA	Int. Shipping Partners
Greece	Ionia Management
Norway	Jo Tankers
Germany	Juengerhans
Greece	Laskaridis shipping
Denmark	Lauritzen
Cyprus	Lemissoler

(*continued*)

Table AI.
List of companies administered with the questionnaire

Country	Company
Greece	Load Line Marine
Greece	Maran Tankers
Greece	M. M. S.
UK	Meridian Marine Management
Sweden	Milestone Maritime
Greece	Minerva
Greece	Minoan Lines
Norway	Mokster Shipping
Italy	Montanari
USA	MT Maritime
Greece	Neda Maritime
Greece	Neptune
Singapore	NOL
Denmark	Nordana
Denmark	Norden
Denmark	Nordic Tankers
UK	Northern Marine Management Limited
Cyprus	Oceantankers
Germany	OLDENDORFF
USA	OSG
Singapore	Pacific Carriers
Germany	R. R. Schepers
Singapore	Rickmers Trust
The Netherlands	Rolldock
Monaco	Scorpio
USA	Seanergy
Canada	Seaspan
Norway	Seatrans
Greece	Seaworld
Norway	Solstad
Greece	Stealth maritime
Norway	Stenersen
Norway	Stolt
Switzerland	Swiss maritime
Singapore	Terra-Marine
Singapore	Thome
Greece	Tomasos Brothers
Denmark	Torm
Greece	Trefin tankers
Greece	T.E.N.
Greece	Tsakos Columbia
Norway	Ugland Marine
Denmark	Unifeeder
Norway	Utkilen
India	Varun
Greece	Ventouris
The Netherlands	Vroon
Sweden	Wisby tankers
Greece	Zela shipping
USA	Zodiac
Cyprus	Interorient
Greece	Thenamaris

Table AI.

Question	Answer type	Description	Reference
		Section 1	
Q1.1 What is the location of your organisation?	Name of country	Identifies the country of origin of the company as the shipping industry is located in multiple countries with diverse regulations in addition to the regulations from the IMO	Yang (2010)
Q1.2 How many years has your organisation been in operation?	Years in operation	Aim to identify the impact of organisation's age on performance	Triantafylli and Ballas (2010)
Q1.3 Your organisation is	Private or public	In their study found differences in operating performance and ownership structure	Lambertides and Louca (2008)
Q1.4 What is your fleet profile?	(Please choose all that apply) Liquid/ Dry/Liners/Passenger/other	Konsta and Plomaritou (2012) identify the tanker sector still in an evolving stage in terms of KPIs but suggests that all companies can benefit from the adoption of PMS	Konsta and Plomaritou (2012)
Q1.5 What is the size of your operating fleet?	Number of ships under management	Evaluates the impact of size on the adoption rate of PMS	Konsta and Plomaritou (2012)
Q1.6 What is the average age of your fleet?	Average age of fleet	Age of fleet found to be associated to performance of shipping companies	Triantafylli and Ballas (2010)
		Section 2	
Q2.1 Which of the following you use to measure your organisation's performance?	(Please choose all that apply) Performance Indicators/Key Performance Indicators/Key Result Indicators/Balanced Scorecard/ Shipping KPI Standard/Gap Analysis/Performance Prism/None of the above/Other (please specify)	Identifies the type of PMS employed	Marr and Schiuma (2003)
Q2.2 For how many years have you been collecting and analysing performance indices?	Range of years	Aims to find out the relation between usage of PMS and performance	Triantafylli and Ballas (2010)

(*continued*)

Table AII.
Questionnaire

Table AII.

Question	Answer type	Description	Reference
		Section 3	
Q3. To what extent do you agree with the following statements with respect to PM within your organisation?	(5 point Likert scale)	Companies with good fit of their management systems and indices experience superior business performance and a higher perceived usefulness of management systems and thus PMS	Triantafylli and Ballas (2010)
	PM has facilitated my organisation's growth PM has protected my organisation from loss and excessive risk PM has helped me benchmark my organisation with respect to the industry PM has helped my organisation gain a competitive advantage over rivals PM is used to enhance my organisation's social and environmental responsibility PM is used for decision making and strategy implementation		
		Section 4	
Q4. How would you categorise your organisation's operational performance with respect to the shipping industry? (Non-financial performance)	In the top 10%/In the top 25%/ Average/In the lower 25%/In the lower 10%	Suggests that there is a positive relationship between pursuing competitive strategies through the use of BPM and company performance in ship management Companies that apply competitive strategies are more likely to be high performers	Panayides (2003)

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