WMU J Marit Affairs (2013) 12:1–15
DOI 10.1007/s13437-013-0039-4

ARTICLE

Innovation types in the Finnish maritime cluster

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Received: 15 October 2012 / Accepted: 19 February 2013 / Published online: 6 March 2013

Abstract The Finnish maritime cluster is an important sector of Finland's economy. However, literature on innovative activities within the cluster is limited. This article focuses on Finnish shipbuilding and marine industry firms. Several innovation types are identified. These are analyzed according to general characteristics of firms. The data is from a survey of 148 shipbuilding and marine industry companies; most of the variables are ordinal scale and are analyzed with standard statistical survey methods. Considering the significance and past technological achievements of the sector the results indicate surprisingly low radical innovation related-activity and attitudes towards it. As well, the results provide no evidence to support previous research, suggesting that the shipbuilding and marine industry produces more organizational than technological innovations. The innovativeness of the firms varies according to distinct characteristics such as size, intensity of in-house and collaborative R&D activities, and level of internationalization. The empirical results provide a platform for policy implications and directions for future research; innovations concerning environmental efficiency are raised as an important future area of development.

Keywords Cluster · Finland · Innovation · Marine industry · Shipbuilding industry

1 Introduction

This paper addresses the innovation activity of shipbuilding and marine industry firms in Finland. The maritime cluster is one of the most significant industrial sectors in Finland's

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economy. It includes approximately 2,900 firms, 43,400 employees, and had a total revenue of 13.2 billion Euros in 2006 (Karvonen et al. 2008). The article deals with the key concept of innovation, as it is a crucial factor in the performance, profitability, productivity, and growth of firms. In short, innovative activity, including research and development (R&D), is positively related to firm-level productivity, performance and market position (e.g., Calantone et al. 2002; Feeny and Rogers 2003).

There is an extensive body of literature discussing the heightened innovativeness, due to positive information externalities and knowledge spillovers, of firms belonging to clusters (e.g., Baptista and Swann 1998; Beaudry and Breschi 2003). Still innovations do not always require a cluster and the mere presence of a cluster is by no means a direct and causal indication of success and high innovative output (Kasabov 2008). Therefore, research elaborating the linkages between clusters and innovation has been a recurring topic inside scholarly debate. However, while high-tech sectors (e.g., Cooke 2002) have been studied intensively with respect to their innovative activities, the maritime industry and closely related fields lack such extensive literature. Innovation in the maritime industry (or cluster) has been studied in some nations or regions: for example in the Canadian province of Quebec (Doloreux 2006; Doloreux and Melançon 2008; Melançon and Doloreux 2011), in the Netherlands (de Langen 2002) and in Norway and Spain, where the innovative activities of the maritime industry cluster (Asheim and Isaksen 2002; Benito et al. 2003; Isaksen 2009) in connection with shipping (Jenssen and Randøy 2002; Jenssen 2003) and the port sector (Blanco et al. 2010, 2011), have been subject to more rigorous review. In Finland, the maritime cluster has been studied quite intensively, and in recent years, this has included economic and employment effects (Viitanen et al. 2003; Karvonen and Holma 2009). However, studies on the innovativeness of the Finnish maritime cluster are relatively few.

Industries can be viewed as clusters or sectoral systems of innovation and production, where agents other than firms are also taken into account (Porter 1990; Malerba 2002; de Langen 2008). These include public sector operations and companies from other industries that collaborate with the maritime industry. In this study, however, the focus is on firms, although the effects of other organizations are duly recognized. The analyses concerns the maritime industry's shipbuilding and marine industry block (shipyards and their suppliers including firms affiliated with machinery, electronics, interiors and security industries), as they comprise, alongside shipping and port operations, the core sector of the maritime cluster.

An innovation is conceptualized here in the traditional way, as the implementation of a new (or significantly improved) product, service, process, marketing or organizational method, to fill a market demand (see Lam 2005; OECD 2005). The paper also applies a conceptual distinction between radical and incremental innovations. Radical innovations are designed to meet the needs of emerging customers and markets, and incremental innovations are improvements on an existing implement designed to meet the needs of existing customers or markets (e.g., Jansen et al. 2006). The distinction between radical (novel) and incremental innovations is important, as radical innovations are more significant contributors to total productivity (Duguet 2006). However, it should be noted that the examination of an innovation's degree of novelty is problematic as there is no clear consensus either on the definition or the operationalization of radical innovations (see Amara et al. 2008). Furthermore,

innovations are viewed from the perspective of demand. Thus, the article separates "product, service, and production" innovations from "organizational and marketing" ones.

As pointed out, there is a gap between the rich literature of high-tech industries and studies on the innovative activities of maritime industry. Here, questionnaire data and statistical methods are applied to shed light upon the innovativeness of the Finnish shipbuilding and marine industry and on the effects of a firm's characteristics (size, the level of internationalization, and R&D activities). The hypotheses drawn from previous research are analyzed according to survey methodology. Due to the properties of the ordinal variables, plot–box, and Mann–Whitney *U* tests are mainly used, to illustrate imbalances between innovation activity indicators. The results are contrasted and discussed in relation to earlier studies. The paper concludes by considering policy implications and directions for further research.

2 Conceptual debates in the literature

2.1 Innovation and firms

R&D efforts and innovation are key factors in explaining a firm's better performance, profitability, productivity, and growth. This is supported by Reichstein (2004) and Morone and Testa (2008), who found statistical evidence of a positive association between high firm growth rates and innovation. Also, in relation to small firms at least, it has been demonstrated that innovating firms outperform their less innovative peers (Roper 1997; Freel 2000).

In general, a firm's size plays a significant role in its innovativeness. This notion is particularly relevant to the maritime industry with its diverse number of companies of various size (employed personnel) and amount of revenue and turnover. While the traditional Schumpeterian way of thinking holds that small firms are at a disadvantage vis-à-vis generating innovations (see e.g. Malerba and Orseniga 1997), more recent studies have stressed the importance of small firms in making a crucial contribution to innovative activity (also Acs and Audretsch 2003) stating that small new entrepreneurial firms are the pioneers of many major innovations as many established firms are unable to enter emerging market niches and outperform the new ventures (Sørensen and Stuart 2000). Accordingly, as proposed by Fritsch and Meschede (2001), it seems that small enterprises tend to be more innovative than large ones with regard to R&D input: R&D expenditure rises less than proportionally with firm size. It also seems that there is no real evidence for the existence of economies of scale qua innovation activity (Arvanitis 1997). Moreover, returns from R&D are decreasing, which implies that small firms are more innovative than large firms, as they obtain more patents and citations in proportion to their R&D spending (Plehn-Dujowich 2009), i.e., the number of innovations increases with more industry R&D spending but at a decreasing rate (Acs and Audretsch 1988). Although the innovative inputs are greater in large enterprises, they do not produce innovations as effectively as in smaller firms. The effects of firm size are also relevant to the kind of innovations made: empirical studies have shown that large firms tend to excel in process innovations while the situation is more level with product innovations (Yin and Zuscovitch 1998; Wagner and Hansen 2005). This

notion is controversial however, as Cohen and Klepper (1996) have shown no innate effect of firm size on R&D and innovation.

In general, collaboration with other institutions such as firms and universities can increase innovative industrial performance and R&D productivity as well as enhance R&D intensity (e.g., Baba et al. 2009; Tomlinson 2010), but cooperating to innovate is more important for small firms, i.e., they overcome limitations by different use of external knowledge and also benefit more from alliances than large organizations (Stuart 2000; Barge-Gil 2010). Firms attempting to introduce higher level innovations (new to the market rather than simply new to the firm) are much more likely to cooperate in order to innovate (Tether 2002). However, the innovativeness of firms having internal R&D and a high rate of highly skilled labor is much greater than that of other firms (Frenkel 2000) and significant innovations are mainly produced in-house, whereas purchased R&D services are more effective in creating incremental innovations (Beneito 2006). Still, cooperation with other firms and research organizations (i.e., the combination of in-house research, design and development efforts with outside talent) is positively correlated with the innovation performance of small- and medium-sized enterprises (MacPherson 1997; Zeng et al. 2010), but does not automatically guarantee the success of innovative projects (Bourgain and Haudeville 2002). Differences also exist in the sources of external knowledge according to the size of firms: university research is a relatively more important source of innovation for small firms, whereas industrial research is more important for large ones (Piergiovanni et al. 1997).

The above-mentioned views have been questioned (Tether et al. 1997; Tether 1998), and it is of course likely that in absolute numbers at least, larger firms produce more innovations than smaller ones. At least micro-firms (less than ten employees) seem to have significant difficulties in turning innovation into positive growth (Morone and Testa 2008). There are also differences in innovative activities between industry branches: high-tech firms exhibit a much greater innovative ability than firms belonging to traditional industries (Frenkel 2000). Therefore, also the effect of firm size on innovating differs between industry sectors: large firms have a relative advantage in some industries (e.g., capital-intensive industries) while in others (e.g., young industries with a large proportion of skilled labor), small firms tend to have the advantage (Acs and Audretsch 1987; Archibugi et al. 1995). However, Tsai and Wang (2005) have demonstrated that the relationship between R&D productivity and firm size is U-shaped (see also Pavitt et al. 1987). This is probably due to the fact that mid-sized firms are more established than small firms and thus have less incentive to innovate while on the other hand lack the innovative capacity of large firms (Bertschek and Entorf 1996).

In addition to the role of firm size, Kafouros et al. (2008) have suggested that internationalization is another significant firm-specific factor which allows companies to improve performance through innovation. Accordingly, it has been shown that the propensity to export is strictly linked to a firm's ability to innovate (Roper and Love 2002; Kirbach and Schmiedeberg 2008). In addition, Rogers (2004) has pointed out that innovation may be higher in exporting firms, whereas foreign ownership may lower innovation. All things considered, the innovative activities of Finnish ship-building and marine industry firms are likely to vary across size groups and industry branches, as well as according to their cooperative innovation activities, degree of internationalization, and export propensity.

2.2 Innovation and maritime industry

The innovation literature most often concerns communications technologies or other rapidly developing technology industries, whereas the maritime industry may be viewed as a traditional industrial branch. However, technological development and automation have had a major impact on management and operational processes in ports and in shipping (Graff 2009; Blanco et al. 2011; Poulis et al. 2011). Accordingly, shipbuilding has been reshaped by growing role of turnkey deliveries, making the shipyards into more assembly-focused operator. Methods for analyzing traditional industries are in some cases poorly suited for investigating the shipbuilding and marine industry, since the shipbuilding suppliers perform a vast number of different functions, especially in cruise ship production, that can involve a couple of hundred supply firms with dozens of different traditional industry codes. Thus, setting up boundaries which firm acts in the maritime industry and which do not is ambiguous. Figure 1 provides a contextual visualization of the diversity of the maritime sector. While the empirical data used here concerns shipyards and their contractors in particular, innovation activity in the maritime industry also concerns the interlinking and enhancement of public–private partnerships.

In comparison, a study on the nature of innovation activities of Quebec's coastal maritime industry reveals that maritime firms are not intensively engaged in developing either product or process innovations, and only few firms have introduced them (Doloreux and Melançon 2008). In a survey of the Dutch maritime cluster, the innovation strategies of firms were found to be quite heterogeneous (de Langen 2002). The survey also indicated that the Dutch maritime industry firms were not intensively engaged in developing product and process innovation and were oriented towards organizational rather than technological innovations.

A good reference for the Finnish maritime cluster is Norway. In a Norwegian maritime cluster (situated in Møre), the number of patent applications is smaller and R&D spending lower than in other industrial clusters in Norway (Isaksen 2009). In the Møre maritime cluster, innovations are mainly incremental improvements (Asheim and Isaksen 2002). A possible explanation for this variation is offered by Benito et al. (2003) who highlight the fact that in Norway many companies in the maritime industry are heavily dependent on a group of very few customers, meaning that the direction and pace of innovations are largely set by a handful of clients, which leads to an apparent lack of interest in innovation. In sum, it can be stated that

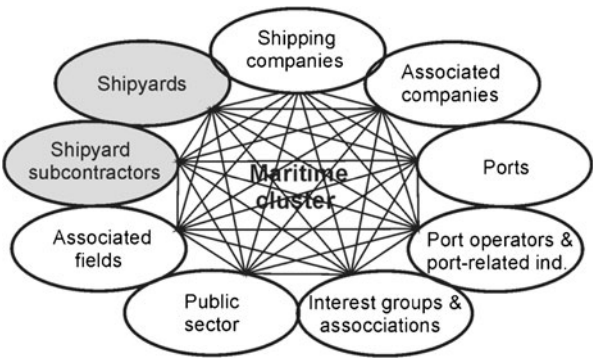

Fig. 1 The Finnish maritime cluster. The sectors under study here are indicated with *gray shading*; modified from (Viitanen et al. 2003)

maritime industry clusters elsewhere (the Netherlands, Norway and Quebec) in the world are not particularly innovative and that they produce more incremental than radical innovations and more organizational than product or process innovations. These notions may also hold true in the case of Finland. Thus, drawing from previous literature on maritime industry, the main hypotheses to be tested in the case of Finnish shipbuilding and marine industry are as follows:

1. The industry produces more incremental than radical innovations.
2. The industry produces more organizational and marketing than product, process, or service innovations.
3. The innovativeness of firms (to some extent) depends on size.
4. The innovativeness of firms is related to the intensity of their in-house and collaborative R&D activities.
5. The innovativeness of firms differs according to their level of internationalization.

The shipbuilding and marine industry's situation also has larger implications for the national and regional economy. As a consequence of the 2008 economic downturn shipbuilding orders broadly halted from 2009 to 2010. Cruise ship orders especially declined, which has had knock on effects for the Finnish shipbuilding network. To counter the unemployment and loss of know-how during the downturn, the Finnish government and regional administrations have established support functions to preserve the industry, including training programs, developing R&D networking between the firms in- and outside of the marine industry and, also universities and innovation grants paid for developing more environmentally friendly ships. Maritime industries should therefore also be viewed from the perspective of the national economy, national legislation, and international trade. Thus, innovations created by the public sector also affect the overall functioning of the Finnish shipbuilding and marine industry and maritime cluster (see Fig. 1).

As discussed, innovation activities in the shipbuilding and marine industry include important policy aspects, due to links with trade volumes and transportation systems both freight and passengers. In this context, policies and their formulation are understood here as public administration regulatory schemes and other activity that have an impact on the maritime cluster (see Fig. 1). This can be defined as a sector approach to industrial organization. The attendant network is complex, due to the large number of public and private organizations. Private companies constitute the grassroots level and carry forward business functions. However, the public sector plays a key role as a legislator of business environment, flattening the shipbuilding and trade volume cycles.

3 Data consideration

The study's data was gathered through a questionnaire (conducted as part of the Innovation, Competition, Assets and Success [InnoCAS] project) directed to Finnish shipbuilding and marine industry firms in a series of telephone interviews between May and September 2009 by the Institute for Competition Policy Studies (currently Centre for Collaborative Research) at the Turku School of Economics. The respondents ($n=148$) were the chief executive officers or persons in other executive

positions of the participating firms. Answers to most of the questions were given as opinions on a scale of 1 to 7 (1=low, 7=high). The questionnaire covered a wide range of topics including innovative activities, strategies, and the resources of firms. It mainly focused on key questions in accordance with the research questions above, i.e., those concerning innovations and firm characteristics (Table 1).

Table 1 shows the topics of the question groups used in the data collection. Each group includes from 1 to 7 individual questions (see Appendix). The first four groups (firm size, in-house R&D, collaboration, and internationalization) may be considered as background variables while the latter four (novelty of innovation 5–6 and type of innovation 7–8) are the dependent variables. The analysis was designed to illustrate the differences between and significance of these main factors. In addition, firms were asked to provide information on their revenue (see Table 2).

Table 2 makes it clear that although the firms are quite evenly spread in accordance to their size, the situation is quite different when the total number of employees or amount of revenue is considered. Although in absolute numbers, large firms comprise only a small proportion of the sample, their influence on the maritime cluster is considerable. The bulk of shipbuilding and marine industry employees work in large corporations and most of the revenue comes from there. Furthermore, Wärtsilä, one of the biggest Finnish conglomerates and active in many fields other than the maritime cluster, is part of the sample. This means that not all of the employees and revenue shown in the Table work in or come directly from shipbuilding and marine industry operations. These notions must be kept in mind when generalizations concerning the data are made. The size class (number of employees) of five firms was missing, as were a number of values for the revenue variable. Also, it must be noted that the interview approach contains limitations. For example, the boundary between product and process innovation is blurry and both tend to be categorized differently depending on who is interviewed (Simonetti et al. 1995). Moreover, senior management, interviewed here, might not be as critical as other personnel when it comes to the degree of innovation in a company. However, the data is valid in terms of management (responsible for the economic success of the firms). The same holds true with the novelty of innovations, as firms may tend to overestimate it (Danneels and Kleinschmidt 2001).

4 Results

The following results were produced as sum variables, which were thereafter divided by the number of questions included, to facilitate the comparison between different tables. The Mann–Whitney statistics were used, because the variables, calculated from the questionnaire, did not follow a normal distribution. From the set of questions (see

Table 1 Questionnaire topics (for full list see Appendix)

1	Firm size	5	Incremental innovations
2	In-house R&D	6	Radical innovations
3	R&D collaboration	7	Product, process, and service innovations
4	Internationalization	8	Organizational and marketing innovations

Table 2 General information on the size distribution of the sample (missing values, $n=5$)

	Distribution number	Distribution %	Employees total	Employees %	Revenue total mil. €	Revenue %
Micro (<10 employees)	30	21.0	155	0.5	33.0	0.4
Small (10–49 employees)	58	40.5	1 367	4.1	321.3	3.6
Medium (50–249 employees)	42	29.4	4 253	12.9	966.4	10.9
Large (≥250 employees)	13	9.1	27 240	82.5	7 578.0	85.1

Appendix) the following questions were merged to depict incremental innovations (Q5a–Q5b) and radical innovations (Q6a–Q6b). According to Mann–Whitney statistics, a significant difference appeared to exist between the shipbuilding and marine industry firms' tendency to produce incremental and radical innovations. Their tendency to produce incremental innovations was greater than that for radical innovations, even after the standard deviation was taken into account (Table 3). Thus, the findings supported the *first* hypothesis: the shipbuilding and marine industry in Finland produces more incremental than radical innovations.

To answer the *second* hypothesis, the following questions were merged to depict product, process, and service innovations (Q7a–Q7d) as well as organizational and marketing innovations (Q8a–Q8g). The numbers of different types of innovation were much alike when the standard deviation was taken into account (Table 3). It seems that the shipbuilding and marine industry in Finland is not oriented towards organizational innovation at the expense of technical innovation but rather the opposite, as shown by the Mann–Whitney statistics. Thus, the data did not support the *second* hypothesis: no evidence exists of the Finnish shipbuilding and marine industry producing more organizational and marketing innovations than product, process and service ones.

Cronbach's α (the most widely applied estimator of reliability) were calculated to estimate the reliability of the produced indicators. The Cronbach's alphas for every indicator were greater than 0.6, which means that their reliability can be considered good or at least fair. The deletion of any of the individual variables from the indicators did not significantly increase the reliability of the indicators (in fact, only the deletion of Q8g from the indicator describing organizational and marketing innovations enhanced its reliability, and only marginally).

Table 3 Novelty and types of innovation

Novelty of innovation	*n*	Mean	Std. Deviation	Median	Cronbach's α
Incremental innovations	148	5.027	1.408	5.500	0.811
Radical innovations	147	3.605	1.326	3.500	0.641
Mann–Whitney statistics			$z=-7.965$ ($p<0.001$)		
Types of innovation	n	Mean	Std. deviation	Median	Cronbach's α
Product, process, and service innovations	148	4.079	1.216	4.250	0.715
Organizational and marketing innovations	145	3.596	1.130	3.714	0.788
Mann–Whitney statistics			$z=-3.615$ ($p<0.001$)		

To depict the overall innovativeness of firms according to their characteristics, the above-mentioned innovation types (Q7a–Q8g) were merged into one innovation measure (Cronbach's α=0.849). To compare the effect of firm size (Q1) on shipbuilding and marine industry innovativeness, a division was made between micro-firms (less than ten employees) and large firms (more than 100 employees). According to the Mann–Whitney statistics, the difference between the two size groups was significant; i.e., large firms were found to be significantly more innovative (Table 4, see also Fig. 2). From this, it can be concluded that the *third* hypothesis is supported: firm size does have an effect on the innovativeness of Finnish shipbuilding and marine industry firms.

A second grouping was made on the basis of the firms' cooperative activities (Q2–Q3). If the firms were more oriented towards innovation cooperation than in-house R&D, they were labelled as collaborating firms. In cases where the opposite was true, the firms belonged to the group of companies that emphasized in-house R&D. Firms with an equally strong concentration on both activities were excluded. The results indicated that firms emphasizing in-house R&D were more innovative, and the Mann–Whitney statistics proved this margin to be statistically significant (Table 4, see also Fig. 2). Thus, the *fourth* hypothesis is supported: there is a difference between the innovative capacities of firms preferring in-house R&D and firms that are more oriented towards collaboration in order to innovate.

A third grouping was formed according to the firms' level of internationalization, i.e., their tendency to export their products (Q4). Non-exporting firms comprised another group and those with export rates greater than 30 % yet another (c.f. Aw and Hwang 1995). From the analysis, it could be concluded that exporting firms had significantly higher rates of innovation (Table 4, see also Fig. 2). Thus, the *fifth* hypothesis is supported: the innovativeness of Finnish shipbuilding and marine industry firms differs according to their level of internationalization. The results are parallel but not as distinct, when the individual indicators, presented in Table 3, where compared according to these three identified groups.

Figure 2 provides a clear visualization of the main independent variables in relation to innovation activity. Differences concerning company size and international

Table 4 The innovativeness of firms according to their characteristics and Mann–Whitney statistics

Firm size	*n*	Mean	Std. deviation	Median
Micro firms	30	2.994	1.015	2.773
Large firms	30	4.321	0.948	4.418
Mann–Whitney statistics		z=−4.402 (p<0.001)		
Collaboration	*n*	Mean	Std. deviation	Median
Collaborating firms	36	3.490	1.014	3.456
Firms emphasizing in-house R&D	51	4.016	0.870	4.182
Mann–Whitney statistics		*z*=−2,350 (*p*=0.018)		
Internationalization	*n*	Mean	Std. deviation	Median
Non-exporting firms	37	3.177	1.068	3.000
Exporting firms	35	4.010	1.078	4.182
Mann–Whitney statistics		*z*=−2.960 (*p*=0.003)		

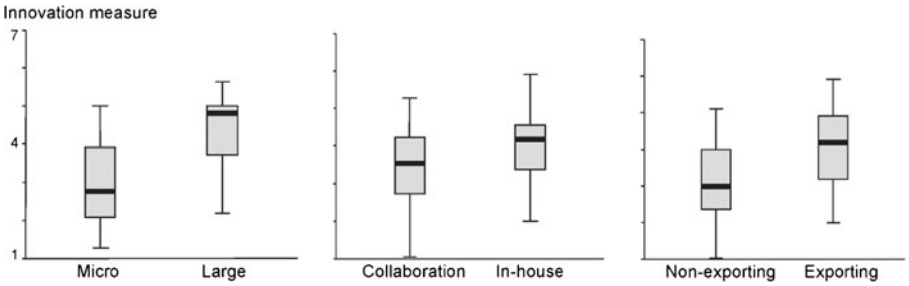

Fig. 2 The innovativeness of firms according to their characteristics

trade (exports) are statistically significant at a 99 % level. In addition, the collaboration variable is significant at a 95 % level (Table 4). Several firms belong to the examined extremes in more than one of the measured groups. Collaboration activities (larger firms investing more in in-house R&D) and internationalization (larger firms tending to export a greater proportion of their products) are a manifestation of the first grouping, firm size. Thus, the independent variables are positively collinear. As a causal interpretation, a company must first gain volume (in terms of finance and employees) to be able to conduct extensive R&D and innovation activity. The growth is accompanied by extending markets (internationalization) and collaboration. All these independent factors contribute to the degree of innovation. This is not to say that small firms are unable to innovate, rather that the bulk of innovative inputs are concentrated in the large companies. Altogether, the analysis indicates that Finnish shipbuilding and marine industry firms are conservative in their innovation levels, except for incremental innovations within the industry.

5 Discussion and conclusions

Selected findings from the InnoCAS survey were presented. The methods used were standard survey tools that may be considered relatively descriptive. A more sophisticated methodology is needed in order to further build upon the extensive work done in collecting the data. The results quite clearly indicate that the Finnish shipbuilding and marine industry is oriented towards incremental innovation within the industry. The answers to hypotheses 1 to 5 formulated at the outset are as follows: (1) supported, the Finnish shipbuilding and marine industry produces more incremental than radical innovations; (2) not supported, no evidence was found of the Finnish shipbuilding and marine industry producing more organizational and marketing innovations than product, process or service ones (rather, the situation was the opposite); (3) supported, the innovativeness of Finnish shipbuilding and marine industry's firms is related to their size (large firms are more innovative in absolute terms than micro-firms); (4) supported, the innovativeness of Finnish shipbuilding and marine industry firms is related to the intensity of their in-house and collaborative R&D activities (firms that are more oriented towards in-house R&D are also more innovative); and (5) supported, the innovativeness of Finnish shipbuilding and marine industry firms differs according to their level of internationalization (exporting firms outperform non-exporting firms as far as innovativeness is concerned).

The findings support the earlier research on the Norwegian maritime clusters (Asheim and Isaksen 2002) and on Quebec's coastal maritime industry (Doloreux and Melançon 2008) by displaying low radical innovation related-activity also inside the Finnish maritime cluster. Contrary, the results did not support earlier findings on the Dutch maritime cluster by de Langen (2002): there is no evident orientation towards organizational rather than technological innovations in the Finnish shipbuilding and marine industry. This deviation, however, might be due to the differences in the sample size and in the backgrounds of the firms surveyed: the data on the Dutch maritime cluster included 16 firms (i.e., the sample is quite small to draw definite quantitative conclusions) active in maritime cargo transport (de Langen 2002). In addition, the respondent profile (managers) may cause some variation in the results. This, however, provides an additional platform for future studies: comparison between different employment segments and their views on the innovation activity within the maritime cluster. These qualitative aspects might be combined with environmental variables of ships exhausts and emissions in order to provide theoretical developments between innovations, economic efficiency, pollution reduction, and environmental legislation.

As radical innovations are considered to be more effective in enhancing the performance and productivity of firms than incremental innovations, policies, (e.g., the Maritime cluster programme already in progress in Finland) supporting R&D and other innovative activities directed at creating new global-oriented innovations are highly welcome in order to improve the competitiveness of the Finnish maritime industry. However, it must be kept in mind that not all firms excel in innovative activities. Firms can direct many of their resources to R&D but still fail to innovate. Innovating therefore involves risks for businesses (e.g., poor functionality or failure to serve the set purpose), and increasing R&D does not automatically lead to more innovation, productivity, and growth for firms. Further investigation into the different innovation strategies of Finnish shipbuilding and marine industry firms and their relevance to the firms' productivity and performance, as well as into the reasons for the apparent lack of concern for innovation, is needed.

Another implication for policy considerations and future research concerns the environment and environmental efficiency (Notteboom 2011). This is an important issue particularly in the Finnish context due to the extensive role of shipbuilding and shipping in Finnish economy and international trade. It is also an international issue, as the rapid increase in shipping volumes in the Gulf of Finland and the Baltic Sea indicates: transport growth has been high during the 2000–2010 period (Inkinen and Tapaninen 2008). Furthermore, recent shipbuilding orders for Turku shipyard, in the spring of 2011, emphasize the growing trend for environmental efficiency (also Klein 2007). Both a cruise ferry and a small special cargo ship equipped to use bio-diesel have been ordered. This may lead into a new longed-for field of business and innovations for Finnish shipbuilders. To conclude, business management of innovation activity is a two-edged sword. Creating innovations may not result in economic success very quickly, and always carries costs that may be considerable. However, innovation and product development are essential in maritime industry: if one will not do it someone else will, thus gaining a competition advantage.

Acknowledgements This research paper is a result of collaboration between projects 127213 (funded by the Academy of Finland) and InnoCAS—innovations, capabilities and strategies (funded by Tekes). The authors would like to thank two anonymous referees for their suggestions to improve the paper.

Appendix

Table 5 Questionnaire

Question (scale)
Please estimate the total number of personnel.
Q1 Last year (2008 or latest)
Assess how much your firm has invested in the following innovation activities during the last three years. Response scale 1 to 7, in which 1=Not at all and 7=Abundantly.
Q2 Research and development (R&D) activities within the firm (1–7)
Q3 Research and development (R&D) activities in cooperation with other organizations (1–7)
What was the proportion (%) of exports and other international activities of your annual revenue?
Q4 Last year (2008 or latest)
Assess the following statements related to products and markets from your firm's point of view. Response scale 1 to 7, in which 1=Totally disagree and 7=Totally agree. (adapted from Jansen et al. 2006)
Incremental innovation
Q5a We frequently refine the provision of existing products and services
Q5b We regularly implement small adaptations to existing products and services
Radical innovations
Q6a We invent new products and services
Q6b We commercialize products and services that are completely new to our firm
During the last three years, has your firm introduced any of the following novelties or improvements. Response scale 1 to 7, in which 1=Totally disagree and 7=Totally agree. (adapted from Community Innovation Survey 2010)
Product, service and production innovations
Q7a New or significantly improved products or services
Q7b New or significantly improved methods of manufacturing or producing goods or services
Q7c New or significantly improved logistical, delivery or distribution methods for your goods and services
Q7d New or significantly improved supporting activities for your processes, such as maintenance systems or purchasing, accounting or computing operations
Organizational and marketing innovations
Q8a New management systems for the production and/or supply operations of your enterprise
Q8b New or significantly improved knowledge management systems to better use or exchange information, knowledge and skills within your enterprise
Q8c Significant changes to the organization of work in your enterprise that increased employee's decision making and responsibility for their work
Q8d A significant change to the management structure of your enterprise, such as creating new divisions or departments, integrating different departments or activities, adopting a networked structure, etc.
Q8e New or significant changes in your relations with other firms or public institutions, such as through alliances, partnerships, outsourcing or sub-contracting
Q8f New sales channels, such as direct selling, internet sales, or product licensing
Q8g Significant changes to the packaging of a product

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