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Andersen, Jakob Axel Bejbro; McAloone, Tim C.; Garcia i Mateu, Adrià

Published in:

Proceedings of the 19th International Conference on Engineering Design (ICED13) : Design For Harmonies

Publication date:

2013

Document Version

Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):

Andersen, J. A. B., McAloone, T. C., & Garcia i Mateu, A. (2013). Industry specific PSS: A study of opportunities and barriers for maritime suppliers. In *Proceedings of the 19th International Conference on Engineering Design (ICED13) : Design For Harmonies* (Vol. 4, pp. 369-378). Design Society.

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INDUSTRY SPECIFIC PSS: A STUDY OF OPPORTUNITIES AND BARRIERS FOR MARITIME SUPPLIERS

Jakob Axel Bejbro ANDERSEN, Tim C. MCALOONE, Adrià GARCIA I MATEU
Technical University of Denmark, Denmark

ABSTRACT

Product-Service System (PSS) business models are finding applications with suppliers and manufacturers across industries, but the models have yet to establish a strong foothold in the maritime sector. A number of metrics for evaluating the attractiveness of PSS business models have been proposed in chiefly design research and operations management literature. This paper applies a number of these metrics to the maritime sector using data from a number of maritime suppliers. It is found that the industry is, at least in some aspects, attractive from this PSS metrics standpoint. To explain the inherent lack of PSS maturity in the industry despite this metrics-based conclusion, the discussion moves beyond the quantitative factors and considers a number of organisational, structural and cultural issues that stand in the way of PSS. This paper is based on the initial responses provided by maritime suppliers in a maritime research consortium in (name of country removed).

Keywords: product-service systems, requirements, recovery strategy, entrepreneurship

Contact:

Jakob Axel Bejbro Andersen
Technical University of Denmark
Department of Mechanical Engineering
Kgs. Lyngby
2800
Denmark
jaban@mek.dtu.dk

1 INTRODUCTION

As industrial products become commoditised and as industrial customers come under increasing pressure to compete on cost, Western suppliers see order books dwindling at an alarming rate. The increase in competence and reach of Eastern suppliers of substitute component has moved a big part of the spending away from Europe and North America.

Nowhere is this tendency more obvious than with the Danish suppliers to the maritime sector. Being an inherently global sector, sourcing maritime components and services in other parts of the world is effortless. Backed by government subsidies and a lower cost of labour, Korean and Chinese ship yards have taken the lead in production and maintenance of the world fleet. Conversely, established Danish ship yards, such as the Lindø Yard, have been forced to close with dire repercussions for the ship yard's predominantly Danish suppliers. According to the Danish Maritime Branch Organisation (Danish Maritime 2011) the share of ships being built in Europe has dropped from about 20% to between 6-10% in 2011. In this financial vacuum, suppliers are attempting to set a new course toward financial prosperity.

As described by Pearce II & Robbins (1994) firms in such predicaments can deploy a number of different strategies for recovering their business; among these are the more conservative *retrenchment strategies* and the more radical *entrepreneurial recovery strategies*.

Among the strategies in the latter category can be mentioned the research field of Product/Service-Systems (PSS). PSS business models have been successfully deployed in companies belonging to other industries facing similar problems - i.e. cost competitiveness and commoditisation. In a PSS, the focus is moved from the mere development and provision of products to the development and provision of a *functional output*. In delivering this functional output, the supplier can choose to incorporate product- as well as service dimensions.

In pursuing such business models, the supplier can mitigate the effects of labour costs, leverage any advantages in competencies and in many cases strengthen the relation to the customer. Despite these favourable characteristics, PSS business models have only seen limited penetration in the Danish maritime industry.

To establish the feasibility of a PSS, a number of factors need to be considered. To simplify the process, several theorists have proposed quantitative metrics for determining key characteristics of a given market setting. This paper seeks to apply well-known metrics to the maritime sector using data provided by small and medium sized supplier companies, who are all members of the PROTEUS consortium (McAloone et al 2011). To further strengthen the empirical background for the study an electronic survey was made in which the PROTEUS companies were asked to deliver company specific metrics crucial for the evaluation of aftersales opportunities. On this basis, it is determined that the industry has a potential - albeit limited to certain areas - for successfully pursuing PSS business models.

In the discussion, the gap between the apparent attractiveness of PSS in the industry and the current low rate of adoption is treated. In explaining the difference, a number of qualitative factors are drawn in; these pertain to the current situation of the suppliers as well as to general cultural and historical characteristics of the industry.

This paper adopts a more strategic perspective on PSS than is the case for previous contributions to ICED and DESIGN (Sakao et al. 2011, Nergård et al. 2006, Mougard et al. 2012), which focus more on operational PSS design considerations. The reason for this is the authors' belief that such a perspective is crucial for establishing a solid understanding of the boundary conditions present in this new industrial context and for setting the stage for future PSS development tasks.

The paper addresses the following two research questions:

1. Does the feasibility of PSS business models in the sector, determined using known metrics, reflect the actual level of PSS adoption in the sector?
2. What are the reasons for any discrepancies?

1.1 The PROTEUS Consortium

The PROduct/service-system Tools for Ensuring User-oriented Service (or PROTEUS) consortium is a Danish research consortium consisting of twelve companies related to the maritime industry. The consortium members are all interested in understanding and realising the potential of user-oriented

Product/Service-System offerings. The PROTEUS companies vary in size from 30-3000+ employees and the companies specialise in technologies ranging from small gaskets to huge two-stroke main engines for ships. The companies also represent a wide variety of business models, ranging from traditional manufacturing firms to engineering consultancies.

2 METHODOLOGY

The central empirical data used in this study has been sourced by way of electronic questionnaires. These questionnaires – which are explained in more detail below – provided a quantitative basis for the discussion. To build on the conclusions derived from the questionnaires, a number of observations from the PROTEUS project were used. PROTEUS has over the course of several years built an extensive empirical database on the Danish maritime industry, through hundreds of hours of interviews, workshops and in-depth case studies.

These empirical data have been supplemented by a literature study of several related and relevant research areas.

3 THEORETICAL BACKGROUND

To properly treat the research object, this paper draws on a number of research areas, ranging from operations management through design research to business management and -venturing.

3.1 Understanding organisational decline

The phenomenon of organisational decline has been treated thoroughly by a multitude of authors (Michael & Robbins 1998, Neely 2009). Various groupings of organisations are used as points of departure for this research. In this instance, the research covering small market share companies (Michael & Robbins 1998) and SMEs (Pearce II & Robbins 1994) is appropriate due to the size of the companies analysed. It is commonly acknowledged, that the nature of the strategies deployed to recover the company from decline is very much dependent on the factors causing this recessionary setting.

Pearce & Robbins list a number of generally occurring recovery strategies for companies in decline: Firstly, “*They can retrench and accept a new, reduced level of operations...*”. Secondly, they can “*...adopt a survival orientation designed to enable the firm to remain viable until uncontrollable influences turn more munificent*” and thirdly, they can “*...redirect their remaining resources toward more promising product-market combinations.*” The latter option is what the authors term an “*entrepreneurial recovery*”. Based on data from a large amount of companies faced with a market in recession, the authors found no evidence within their data that this type of entrepreneurial recovery has merit. This conclusion is backed by a similar analysis performed by Chowdhury & Lang (1996). In a related study, Simon & Shrader (2012) point out that dissatisfied managers have a tendency to launch high risk products in new market settings resulting in poorer performance and eventually; dissatisfied managers.

However, in another study by Covin (1989), a crucial dimension is added to the field; this study shows that the level of hostility in the environment of the company is critical in determining the best performing strategy. In a benign environment, efficiency steps (*retrenchment*) are advisable, but if the environment is hostile to the company, an *entrepreneurial recovery* is likely to be the best performing strategy.

Based on the observed complete reconfiguration of the network of Danish suppliers, the significant disadvantages in labour costs, the threat of subsidised competitors and the complete change in infrastructure, the authors of this paper argue that the Danish suppliers treated herein are in many cases placed in a hostile environment. Following this acknowledgement, the adoption of *entrepreneurial recovery* strategies is likely to yield the best performance. As an added note, Chowdhury & Lang (1996) acknowledge the potential of pursuing *entrepreneurial recovery strategies* as a means to achieving long-term growth after successfully having pursued a retrenchment strategy.

3.2 The Promise of Product/Service-Systems

Since its emergence in the beginning of the new millennium, the Product/Service-System research field has at its very core been concerned with addressing the need of manufacturers to compete in novel ways when facing the onslaught of low cost competitors in a global market (Tukker & Tischner 2006). The PSS is a complete reformulation of the manufacturer’s product-centred perspective on

design, development and business creation. By focusing on the functional output of the product in its use phases and not merely the product, PSS providers become able to leverage the organisational competencies and create offerings that are not easily copied by competitors (Mont 2002).

Although PSS's can be seen in a wide range of manifestations (Tukker 2004) of varying complexity and extent, they can be commonly characterised as requiring large changes to business dimensions internally and externally to the company. An overview of the complexity involved with formulating a PSS-based strategy can be seen in the cross-company case study by Neugebauer et al. (2012); here relevant topics pertaining to internal and external dimensions of six overall categories are listed. The overall categories "Stakeholder and stakeholder processes", "Physical assets", "Capabilities", "Influencers", "Network" and "Offering" are in turn divided into a total of 35 important topics.

These topics will, to a large extent, be linked to general attributes for the market. Seeing that PROTEUS seeks to develop and deliver recommendations for companies across the maritime industry, it seems feasible to establish a sound general understanding of the nature of the market before venturing into company-specific PSS development tasks. A further argument for this is the intrinsic idea of vertical and horizontal value chain integration in PSS. In establishing new relations, the companies involved are in all likelihood faced with the same contextual challenges, necessitating solutions that take these into account. This notion of designing a PSS for a whole industry and not a specific company is new in PSS research.

It is clear, that the implementation of a PSS requires a complex and extensive reconfiguration of the manufacturers' business. Revisiting the different recovery strategy definitions of the previous section, it is clear that PSS, as a strategy for recovery, falls squarely into the realm of *entrepreneurial recovery*. Staying with the definitions provided by Pearce II & Robbins (1994) the notion of redirecting the company's efforts toward "*promising product-market combinations*" clearly resonates with the ideas of PSS – albeit without service being mentioned.

Table 1. Wise & Baumgartner's: How to scope out a downstream opportunity

Dimension	Attractiveness of downstream business			Importance of customer relationships			Power of distribution channel		
	Ratio of installed base to new product sales	Life cycle economic activity as a multiple of product cost	Difference between downstream margin and product margin	Magnitude of product based differentiation (excluded)	Market share of top five customers	Share of total profit earned from top 20% of customers	Distribution and selling expenses as a percentage of product price	Degree of channel concentration: market share of top five distributors	Degree of channel innovation or multiplication
Threshold values	Factor	Factor	Percentage point		Percentage	Percentage	Percentage	Percentage	Scale (1-6)*
Downstream moves are relatively unattractive or unimportant. Focus on traditional manufacturing strategies	<8,0	<2,33	<-3,33		<23,33	<40	<23,33	<23,33	<2,33
Downstream activities are potentially troublesome. Monitor and experiment	8,0-14,0	2,33-3,66	-3,33-3,33		23,33-36,66	40-50	23,33-26,66	23,33-36,66	2,33-3,66
Downstream moves are attractive or imperative	>14,0	>3,66	>3,33		>36,66	>50	>26,66	>36,66	>3,66

* 1=Stable and monolithic, 6=dynamic or multiplying

The point that PSS belongs to the entrepreneurial recovery category is however not in itself a reason for pursuing it as a business strategy. For it to be a viable strategy there has to be a market for the proposed PSS business model. Literature provides a mass of approaches to evaluate the attractiveness of such a market. Wise & Baumgartner (1999) have designed a widely adopted framework for evaluating the potential of capturing value at "*...the customer's end of the value chain*". The

framework relies on a number of quantitative measures relating to “*the attractiveness of the downstream business*”, “*the importance of customer relations*” and the “*power of the distribution channel*”. These overall categories are each divided into three specific metrics - as can be seen from Table 1. For each metric, intervals are defined for the level of attractiveness of the downstream opportunity. Note that the authors have added threshold values for each metric, based on visual inspection of the original representation.

4 THE POTENTIAL OF PSS STRATEGIES FOR DANISH MARITIME SUPPLIERS

Below, the approach to gauging the Danish maritime industry using data from the PROTEUS companies is described. Subsequently, the results of the analysis are presented.

Sourcing the data

To collect data from the PROTEUS companies, an online questionnaire was created. To accommodate an anticipated use of Customer Relationship Management (CRM) systems and company databases in answering the questionnaire, the companies were asked to choose a specific offering in their portfolio and fill in answers based on that specific offering. The companies were also instructed to pick an offering that was core to the business in terms of contribution to financial turnover and bottom-line. The questionnaire contained a number of questions relating to different research agendas. As such, the questions specific to Wise & Baumgartner’s metrics were only a subset of the overall data collected. Despite being an online questionnaire, the respondents would often have to source the answers from different departments. In some cases this was done by circulating a printed version of the questionnaire and leaving it to one employee to fill the inputs in to the online questionnaire. In all cases, the person filling in the questionnaire was working at a management level in business units related to service and aftersales. At the moment of writing, four out of twelve companies have responded fully to the questionnaire.

Table 1. Company results

Company values	Attractiveness of downstream business			Importance of customer relationships			Power of distribution channel		
	Ratio of installed base to new product sales	Life cycle economic activity as a multiple of product cost	Difference between downstream margin and product margin	Magnitude of product based differentiation (excluded)	Market share of top five customers	Share of total profit earned from top 20% of customers	Distribution and selling expenses as a percentage of product price	Degree of channel concentration: market share of top five distributors	Degree of channel innovation or multiplication
Company 1	30	2,35	n/a		60	60	18	50	2
Company 2	125	1,725	25		28	28		5	5
Company 3	8,6	0,6	15		60	20	50	70	1
Company 4	11,1	1,25	30		n/a	n/a	10	80	2
GE (reference)	22	21	6-8		75	50	22	n/a	1-2

4.1 The results

Table 2 shows the results of the responses to the questionnaire. The metrics for General Electric Locomotive used in the Wise & Baumgartner (1999) paper are also included as a frame of reference. Although there are noticeable differences between the metrics gathered from each of the PROTEUS companies, the ensuing analysis will focus on the general characteristics and, where possible, underline these with general, qualitative and quantitative knowledge of the companies. Note that the metrics on the *magnitude of product-based differentiation* are excluded as consistent data were not available at this point. This shortcoming will be mended in future versions of the questionnaire.

4.1.1 Attractiveness of downstream business

According to Wise & Baumgartner, it may be sensible to pursue downstream activities if the number of installed units requiring service and maintenance is much larger than the annual new sales. This does however also require that a certain amount of profits can be made from the installed base – a

number that relates to the economic activity in the downstream phases and the margins that can be expected.

The PROTEUS companies report a medium to high ratio of installed base to annual new sales. In contrast, the magnitude of the lifecycle economic activity is very limited compared to the economy up to and including delivery. The latter is somewhat compensated for by margins on aftersales that are significantly higher than for product sales.

When one considers the magnitude of the two different economies, one has to bear in mind that the life cycle economy unfolds over a much longer period than the sale and distribution of the product. The products in mention have reported lifetimes ranging from 15 to more than 30 years. By dividing the ratio of life cycle economic activity to product cost by this expected life time and multiplying by the size of the installed base, a rough estimate for the size of the total annual life cycle economy as compared to the product sales is reached – see Table 3.

Table 3. Relative size of total annual lifecycle economy

	Ratio between total annual lifecycle economy and annual sales
Company 1	3,5
Company 2	7,8
Company 3	0,2
Company 4	0,9
GE*	30,8 (15), 23,1 (20), 15,4 (14)

* The parentheses shows different life expectancies in years.

Values above one mean that the economy in the life cycle and potential annual turnover is larger than the economy involved in selling. Here, one has to remember that whereas the economic activity related to sales is inherently linked to the supplier, the life cycle economy is much more diversified, as other 3rd party companies such as service organisations can also do maintenance and repairs. Unless the product supplier has a formal or competitive advantage in this life cycle economy, there is no guarantee that they will capture and hold more than a limited share of the total market value.

The numbers indicate that some suppliers have a large potential turnover compared to the turnover from sales – even if the market share in the life cycle economy is limited. For these companies, there is a financial basis for pursuing PSS strategies. For other companies, a market share of a 100% would still yield a turnover that is smaller than the current turnover for sales, making moves toward PSS less attractive.

4.1.2 Importance of customer relationships

The metrics on market share to five biggest customers clearly indicate that most of the respondents are dependent on a limited number of very important customers. According to the Wise & Baumgartner framework, this means that there is sense in trying to strengthen the relationship to these customers. According to Mont (2001) the strengthening of the relationship to the customer is one of the benefits of pursuing a PSS strategy. Looking at the profit contribution from the top 20% of customers it is clear that company 1 is able to achieve a higher margin on sales/services for these customers, further underlining the feasibility of strengthening the relationship. Companies 2-3 show only little and no increase in margin, respectively, meaning that this metric does not add to the potential feasibility of PSS offerings.

4.1.3 Power of distribution channel

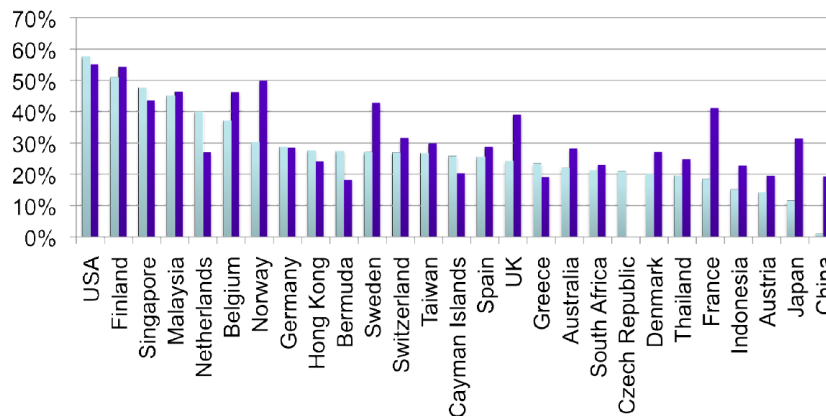
The costs pertaining to distributing a product can vary quite a bit – this is also the case for the respondents. Only one respondent reports distribution costs that fall into the Wise & Baumgartner bracket suggesting a PSS strategy (>26,66%). A large share of costs going to distribution is only problematic if the distributor has a strong position. In that case, the distributor will be able to negotiate favourable prices eating into the profit margin of the manufacturer. For the respondents, this is only the case in one instance – company 3. This clearly indicates that alternative configurations should be considered. Unfortunately for company 3, the degree of channel innovation is at a minimum, meaning that customers are not used to or willing to deal with alternate distributors. The reasons behind this will become obvious in the discussion.

Generally, for the remaining companies, one can conclude that the companies are either fairly unexposed and/or in a reasonable bargaining position with regard to their competitors. For these companies, the distribution channel metrics provide no argument for pursuing PSS strategies.

4.1.4 PSS in The Danish maritime industry

In the period from 2007-2011 there was a growth in the number of service-oriented manufacturing businesses in Denmark, according to a statistical analysis by Neely et al. (2011) – see Figure 1. The rate of growth is however nowhere near that of (near-) neighbouring countries like the UK, Sweden, Norway and France. Also, the total share of service-oriented businesses in Denmark is noticeably lower than the countries mentioned. These numbers are not specific to the maritime sector, but there is little evidence showing that this tendency should be different – on the contrary, the maritime sector is characterised by traditional value chains that are poor facilitators for service provisions.

Figure 1. Servitisation by country (Neely et al. 2011)



The light blue columns represent data from 2007 and the darker columns represent 2011 data.

The level of PSS-orientation in the PROTEUS consortium varies quite a bit. A few, larger companies provide a number of advanced services related to anything from performance contracts to financing. Most of the companies do, however, see the services as a supporting activity for product sales. In many of these cases, the companies have yet to turn a profit on the service provisions.

These statistics and observations are of course not directly coupled to the potential described above, but they do indicate that there is an unrealised potential for PSS offerings in the Danish maritime industry.

5 DISCUSSION

In the previous sections, the Wise & Baumgartner framework for evaluating the attractiveness of “downstream moves” has been used as a proxy for indicating whether a PSS strategy is a viable approach for the companies concerned. This evaluation has led to a mixed conclusion, showing that PSS is, at least in some cases, an interesting alternative.

In the discussion we move beyond the bounds of the Wise & Baumgartner framework and consider a number of other important contextual characteristics as well as their influence on PSS adoption rates in the Danish maritime industry.

5.1 Organisational decline

As mentioned in the theory section, companies can find themselves in decline because of a number of factors – internal as well as external. In finding a way out of the state of decline, the consideration of market conditions is crucial. The company cases presented by Wise & Baumgartner (1999) are all situated in relatively stable market conditions. The same conditions cannot be used for the maritime sector as it has seen massive changes and reconfigurations over the last decades. For instance, the emergence of the East as the world’s shipbuilding epicentre has all but abolished the traditional supply chains of many Danish suppliers. This especially affects the smaller suppliers who have always lacked the resources to maintain an international presence. For instance, one Danish maritime supply

company observed during this research has experienced a drop in turnover and number of employees of approximately 90% during the last 5 years.

5.2 Market culture

As indicated earlier, the maritime industry is old and very much bound by tradition. This influences the self-perception of the suppliers, who are used to being placed in certain, predefined, parts of the value chain. There is in some cases an inherent unwillingness to experiment with new business models, as this could be seen by the customer as lack of professionalism.

This conservative stance was experienced in PROTEUS when a suggestion for a loose dialogue concerning new business models between a ship owner and two suppliers was dismissed. The reason for the dismissal was a fear that the ship owner's view on the suppliers would be changed and that the dialogue would be seen as a strategic collaboration and integration in the value chain.

Surprisingly, the ship owners, who have also been severely affected by the financial crisis, have shown an unprecedented willingness to initiate a dialogue concerning new business models. The suppliers are only slowly beginning to realise this fact. An increased level of business model innovation would be an important stimulant for the adoption of PSS in the industry.

5.3 Regulation

When reviewing the metrics of the Wise & Baumgartner framework and discussing its implications, an important factor was intentionally left unmentioned – regulative influences on the maritime industry. Due to its high emissions levels, pollution risks and general environmental footprint, the maritime industry is highly regulated. This has vast implications for the types of business models the manufacturer can pursue. In one case, the distribution partner of a PROTEUS company is defined by law to be a specific company. This eliminates all opportunities for bypassing this specific partner whose bargaining position is very strong, which in turn effectively overrides any recommendations made by the Wise & Baumgartner framework within that subject.

Incidentally, the latest revision of the same rules adds to this incompatibility with the Wise & Baumgartner framework. In seeing the calculated figures in Table 3 it is clear that company 3 should see little reason for entering into competition on a very small after-sales market. However, it now seems plausible that future regulation will require the service to be provided by the manufacturer or a 3rd party approved by the manufacturer. This rule would essentially enable the manufacturer to capture the whole life cycle economy for its systems.

5.4 Financial resources

Even if the prospect and feasibility of PSS strategies was absolutely clear, many companies would still be facing an insurmountable barrier – that of investment. Some of the companies have navigated the changes in the market unscathed, some even achieving overall growth. For many companies however, the last years have meant cutting costs and cutting staff in an attempt to retrench the company. The pursuit of new sales- and distribution channels has most likely also resulted in added costs. The consequence is a reduced liquidity which, coupled with reduced credit ratings and increased financing costs, results in a lack of ability to invest in novel PSS strategies and an *entrepreneurial recovery*. As the execution of such new PSS strategies is known to be complex and time-consuming, the risk involved in investing a large share of the company's assets quickly becomes too large.

5.5 Global support or no support

If a Danish supplier to the maritime industry was to integrate vertically and bypass a strong distributor, they would be facing another significant problem - reach. Under normal circumstances, the distribution network can be set up locally tending to local customers and from there it can grow. The same is the case for maritime suppliers whose customers are in local maritime sectors such as ferry transport, fishing or perhaps support for the offshore industry.

A large part of the maritime industry is however in global operation with routes circumventing the globe. In signing a service contract with such a company, the ability to service the customer's vessels - wherever they are - is crucial. If the supplier is not able to do this, the customer is unlikely to commit.

In other words, one can say that a critical level of global support is mandatory for many customers. One way of achieving this is to rely on the infrastructure of other companies. Unfortunately, we are

then back at the point of departure, where the Wise & Baumgartner framework recommends looking for ways to bypass distributors.

5.6 Knowledge, competencies and structure

In pursuing a PSS strategy, a traditional manufacturing company will face a number of human resource-related barriers. The governing logic of the business will be changed radically and so will the role of the employees. It is obvious that such a transition will require orchestration and that such orchestration will need a special set of competencies and knowledge, which is probably unfamiliar to the company. This issue is worsened if the company's competencies and knowledge have been eroded in recent staff cuts.

Regardless of whether the competencies and knowledge needed for executing the PSS are acquired through training the current personnel or by hiring new staff, a large amount of scarce resources are needed – time and money. This of course, stands in the way of the company adopting a PSS strategy.

5.7 Developing the PSS

In developing the PSS to suit one or more companies in the maritime industry, it is clear that a number of industry-wide boundary conditions should be considered. Companies in organisational decline cannot commit to large (global), elaborate product- and service constellations meaning that agile and easily adoptable solutions should be developed. Such solutions have to take into account the inherent inability to pursue novel ideas in the business – this inability being driven by cultural factors as well as regulatory restrictions. The level of investment needed to pursue the new solutions should be limited or alternatively, ways of curbing the need for investment should be proposed. Finally, it is clear that any proposed solutions should be rooted in the current capabilities of the company. It would greatly undermine PSS adoption, if the level and type of competencies and knowledge needed for executing and operating the PSS is inappropriate and unattainable.

6 CONCLUSION

As established in the analysis there are a number of reasons for Danish suppliers to pursue PSS-based strategies. This has been shown by applying well-known metrics for evaluating the aftermarket business potential and by consulting the research literature on the feasibility of different types of recovery strategies. According to the latter, Danish suppliers faced with hostile market conditions could benefit from so-called *entrepreneurial recovery* strategies.

Despite this, it is clear that only a limited number of companies are adopting PSS strategies - or any other entrepreneurial recovery strategy for that matter.

In the discussion it was shown that this discrepancy between the recommendations and actual strategies adopted in the industry can most likely be attributed a number of complex contextual factors such as the affliction of organisational decline, the culture of the market, regulatory pressure, limited financial resources, inability to provide global support and a lack of appropriate competencies and knowledge.

7 IMPLICATIONS

Research in other industries has shown that the best way to combat organisational decline in a hostile market is to pursue new, “...*promising product-market combinations*” (Pearce II & Robbins 1994) through entrepreneurial recovery strategies such as PSS. Currently, Danish suppliers faced with decline are focusing on more conservative retrenchment strategies, which, according to literature, are less likely to succeed. There is a need for supplying the Danish suppliers to the maritime industry with custom-made PSS business models that on the one hand ensure a strong and sustained competitive position and on the other hand respect the complex factors governing the industry.

The authors of this paper are suggesting that in approaching a new industry, looking to develop PSS solutions, one can benefit from including industry wide factors at an early stage instead of waiting for company-specific PSS development projects to yield learning insights of general relevance.

8 LIMITATIONS

The analysis presented herein is based on a single framework (Wise & Baumgartner 1999), which is intended to provide only indicative conclusions. It is the ambition of the authors to strengthen future publications by using competing and complementing metrics.

Also, the analysis is hindered by the low number of respondents. It is the intention of the authors to acquire data from a much higher number of respondents, as general conclusions are hard to make on the current basis.

ACKNOWLEDGEMENT

The authors would like to acknowledge the Danish Maritime Fund and the Danish Agency for Science, Technology and Innovation for the financial support of this research and also the PROTEUS consortium partners for providing access to their practices, data and experiences.

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