



## Technology foresight in asset intensive industries: The case of Russian shipbuilding



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### ABSTRACT

Developing competitive national shipbuilding industries is a strategic priority for many countries. Shipbuilding has evolved into a high tech industry over the last few decades that is strongly driven by customer needs and wishes. Consequently economic development of the industry is now far more complex than previously.

International competition in the shipbuilding industry is very strong in all segments of the industry. The article assesses the future development of the shipbuilding industry globally and evaluates the position and opportunities for Russian shipbuilding. International experience of estimating industries' future development shows that a necessary condition of success is building a vision of the industry's long-term future in the context of social and economic development. One way to create such a long-term vision is through developing scenarios based on factors including wild card events, global challenges, trends, threats, drivers, barriers, and limitations.

One of the most effective approaches to enhance competitiveness of the industry is Technology Foresight. The paper presents results of Foresight for civil shipbuilding in Russia on the basis of benchmarking, expert procedures and scenario analysis. It demonstrates how Technology Foresight was adjusted to the special conditions of Russia as an emerging country and how the special features of strategic industries which are in the national interest of countries can be included in Technology Foresight studies. Finally the article derives strategies for policy making to set priorities for revitalizing the industry.

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### 1. Introduction

Shipbuilding is an industry with a strong impact for the wide range of related industries. Accordingly, maritime nations pay particular attention to the development of innovative technologies, e.g. abrasion-resistant coatings, and lighter structures. Despite increasing numbers of shipbuilding companies merging into transnational corporations, we still witness trends where such companies make unique and diversified products, and specialize in building particular types of ships and equipment with particular properties.

It is common knowledge that for countries with a developed shipbuilding industry, the elaboration of appropriate technologies is regarded as one of the national priorities. Developments in the interest of the shipbuilding industry can be used in a number of related industries (aircraft & space engineering, consumer goods etc.). So the shipbuilding industry is often considered a national priority industry which is why governments often argue that they have to support this industry with multiple forms of interventions. However, the literature frequently argues that government interventions are a barrier for restructuring and renewal of the industry itself (Eich-Born and Hassink, 2005). Despite being an obstacle for innovation, the shipbuilding

industry has developed into a knowledge intensive high tech industry over the past few decades. Currently the industry is challenged to maintain the high level of innovativeness and to assure innovation activities are targeted and absorbed by the final users and by the ongoing globalization of economies, markets and value chains which have led to an increase in the volume of seaborne transport (Jenssen, 2003; Jenssen and Randøy, 2006). Consequently transport companies have started requesting a greater variety of ships for different purposes to respond to changing market environments (Yang et al., 2009; Evangelista and Morvillo, 2000; Notteboom and Winkelmann, 2001). Despite the increasing demand for ships, competition in the shipbuilding industry has also grown strongly. In light of the increased demand for ships it could be assumed that the shipbuilding industry would significantly increase capacities. However expanding the manufacturing base in shipbuilding implies an increase in the stock of tangible resources which is strongly determined by the risk attitudes of shipbuilding companies. In this regard Pino and Greve (2006) found that companies performing close to or below the expected performance are more risk averse, and hence are less likely to expand capacities (Greve, 2003; Thompson, 2005; Heaver, 2002). Currently there are about 560 shipyards in the world with a total annual output capacity of 55–60 million Compensated Gross Tonnage (CGT) but their core constitutes 166 shipyards accounting for 85% of global shipbuilding output (Hassink and Shin, 2005; Giovacchini and Sersic, 2012).

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The development of merchant fleet and civilian shipbuilding is the first derivative of global economic (and global trade) development. Despite the fact that the current – post-recession – state of the global economy is very unfavourable in terms of accurate forecasting of freight shipping market growth, the key trends in the global civilian shipbuilding are quite apparent, both in the short and long term.

The outlined developments of the shipbuilding industry raise the question how the global industry might develop in future and which structural changes are emerging in the industry as well as which factors will drive the reshape of the industry. It's widely accepted that the shipbuilding industry enjoys a status as one key strategic industry of national interest in many countries. Therefore countries are continuously looking for potential developments of the global shipbuilding industry and the impact of these trends on the national industry segment. In recent years the respective countries undertook Foresight in order to elaborate potential future developments (European Commission, 2009, 2012).

In light of these developments and the very special characteristics of the shipbuilding industry the question arises how Technology Foresight can be used to develop scenarios system of priorities which serve the purpose of developing the shipbuilding interest for commercial purposes and also to consider the political agenda which considers shipbuilding an industry of national strategic interest. The main feature of the Technology Foresight is that it involves many experts to discuss the current and prospective state of the shipbuilding industry as a whole and also to determine the main drivers and obstacles for the industry's development. This is all the more important as shipbuilding continues to be recognised as a critical industry by countries with reasonable maritime access such as those states with deep water coastal borders. It also shows that shipbuilding has developed from a pure manufacturing-oriented industry into a high tech industry which goes far beyond the traditional style. Therefore assessing the national industry's competitive position requires more than just assessing actors' market position. Instead, a more technology-oriented focus is needed which requires relevant technological expertise (Cooper, 2006; Panayides, 2003).

Furthermore shipbuilding has developed into a knowledge intensive industry which involves a strong contribution from the service sector. The main research question of this article is: How are the special characteristics of asset intensive industries in emerging economies treated in a Technology Foresight?

To answer this research question the article uses the shipbuilding industry as an example industry, e.g. the case of shipbuilding in the Russian Federation. The article starts with an overview of the main features of Russian shipbuilding industry followed by a description of the methodology which was used. The succeeding chapter introduces the finding and the concluding chapter discusses the results and draws conclusions on the methodology.

## 2. Background – features of the Russian shipbuilding industry

The Russian shipbuilding industry has been far behind international competitors in most industry segments in the beginning of the XXI century. However since shipbuilding is also one of Russia's national priority industries, the Russian government has developed special measures for shipbuilding. Russia's national program 'Development of shipbuilding in 2013–2030' notes that 'the main competitive niche for the Russian shipbuilding industry on the global market is in creating high-technology, unique, small-series vessels to develop hydrocarbon deposits on the continental shelf of freezing Arctic and Far Eastern seas'. The shipbuilding industry's development in production and forward-oriented R&D is limited by the number of basic platforms representing vessel and maritime equipment groups with common crucial technological requirements.

Traditionally the industry is divided into the shipbuilding and ship repair sectors; manufacturing of vessels' hardware, electrical engineering, and manufacturing of navigational instruments. In addition to organisations supervised by the Russian Ministry of Industry and Trade, there are over 200 enterprises which design river and maritime

hardware and equipment, and build and repair ships with displacement of up to 5000 tons (Executive Order of the RF Ministry of Industry and Energy of 06 September, 2007). In value terms, the bulk of the shipbuilding industry's stock of orders comes from naval shipbuilding products for Russian navy, which explains why government defence orders dominate the Russian shipbuilding industry's output.

Internal water transport carries 10–15% of freight and about 5% of domestic passenger traffic within Russia. Its main advantage is low costs despite being limited by seasonal operation. In recent decades the use of internal waterways transportation has increased but still lags behind demand due to shortage of ships. This is especially because the existing passenger (cruise) fleet, built almost exclusively abroad (in Germany, Austria, etc.), has exceeded the moral and physical depreciation standards (most of the ships are 40–50 years old). Moreover, its passenger fleet was built at a time when new vessel types (hydrofoils, hovercrafts, etc.) were emerging and when Russia had a significant technological lead.

Maritime vessels and equipment for developing shelf deposits are needed to increase the share of explored reserves and the volume of shelf-based hydrocarbon production. Most of the resource potential is concentrated in the Arctic Ocean seas and their coasts which have special environmental and harsh climatic conditions. Radically new types of maritime vessels, technologies and equipment are required, including for underwater and sub-glacial operation. Other problems with developing Arctic deposits include poor coastal infrastructure and the region's particularly vulnerable environment. For the Russian continental shelf we can expect an increased depth of product processing formation at offshore platforms, production of oil products or synthetic fuel and their subsequent shipment to consumers and a gradual shift to underwater (sub-glacial) shelf development technologies at all stages from exploration to processing in the next 20–30 years (Dekhtyaruk et al., 2014).

## 3. Methodology and approach to shipbuilding technology foresight

We chose a 5 stage methodology for the Technology Foresight (Fig. 1).

### 3.1. Knowledge base development

At the first stage we elaborated a special knowledge base which included more than 90 studies in the field of shipbuilding. Benchmarking allows identifying the best international practices for the development and application of innovative products and technologies, as well as to position Russia's shipbuilding industry among the industry's world leaders. Accordingly, data were selected and analysed in accordance with approaches which involved identifying global and national development trends in the shipbuilding and ship repair industry; discovering the future challenges and threats on global, national and industry levels; comparative analysis of major international shipbuilding companies' development potential; systemic analysis of barriers and limitations hindering the industry's innovation-based development; building scenarios for the future; and integrating the resulting knowledge into the management decision-making process.

### 3.2. State of the art and trend analysis

To identify emerging and potential trends in the Russian shipbuilding and to assess the level of R&D and production of the various classes of ships, six intensive workshops with 50 industry experts from different fields were carried out. The workshops were complemented by an expert survey involving various types of questionnaires to examine dedicated areas of development in the shipbuilding industry. The survey and the workshops were enablers to develop forecast estimates for the industry, detect correlations between the specificities of the industry, and reach consensus between the industry experts about potential development scenarios (Karasev and Vishnevskiy, 2013; Vishnevskiy et al., 2015a). The workshops and the surveys were always targeted at experts who were presumed knowledge holders for commercial

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