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Restructuring of the Croatian Shipbuilding Industry

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Abstract

The restructuring and privatization of the Croatian shipbuilding industry are critical elements of transitional reform and development policy of the entire country of Croatia. One causative factor making these changes necessary is competition on the global level. Additionally the process which, due to the importance of the shipbuilding industry in Croatia's economic structure definitively exerts an influence on the change of a principle of income-generating economy which prevailed in the socialism to the principle of profit, which dominates in the market-based economy.

The paper provides an analysis of the European (LeaderSHIP 2015) and the Croatian shipbuilding industry including shipbuilding potentials, the macroeconomic impact of the shipbuilding industry and of its restructuring and privatization.

The case study presents the example of restructuring at the Brodosplit Shipyard Company, located in Split, Croatia. By utilizing the case study methodology, the outsourcing-based restructuring model of Brodosplit is developed, with the intention of identifying the core activities of the shipyard, which should be kept within the enterprise and further optimized. Following such identification the "standard"/strategically insignificant activities are to be outsourced into a network of small and medium-sized businesses.

Finally the basic characteristics and organization of the shipbuilding cluster of the Split-Dalmatian County are represented here.

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1. Introduction

Market orientation, i.e. production and/or provision of services for the specific customer can be identified as one of the most significant factors in securing “market survival”. Besides, the market turbulence requires continuous adaptation to the global trends, which correspond to high quality, standard-compliant products and services; lower time to market and time to customer; lower prices, based on the target costing model; more complex products and production processes, etc. Therefore, it could be suggested that the time becomes a significant issue related to competitive success – the “big fish do not eat the small ones”, but rather the “agile eat the slow ones” (Figure 1). Following the idea that the “only the fact of change remains the same”, agility and flexibility requirements are increased by the changes of society, market, process, and product structure.

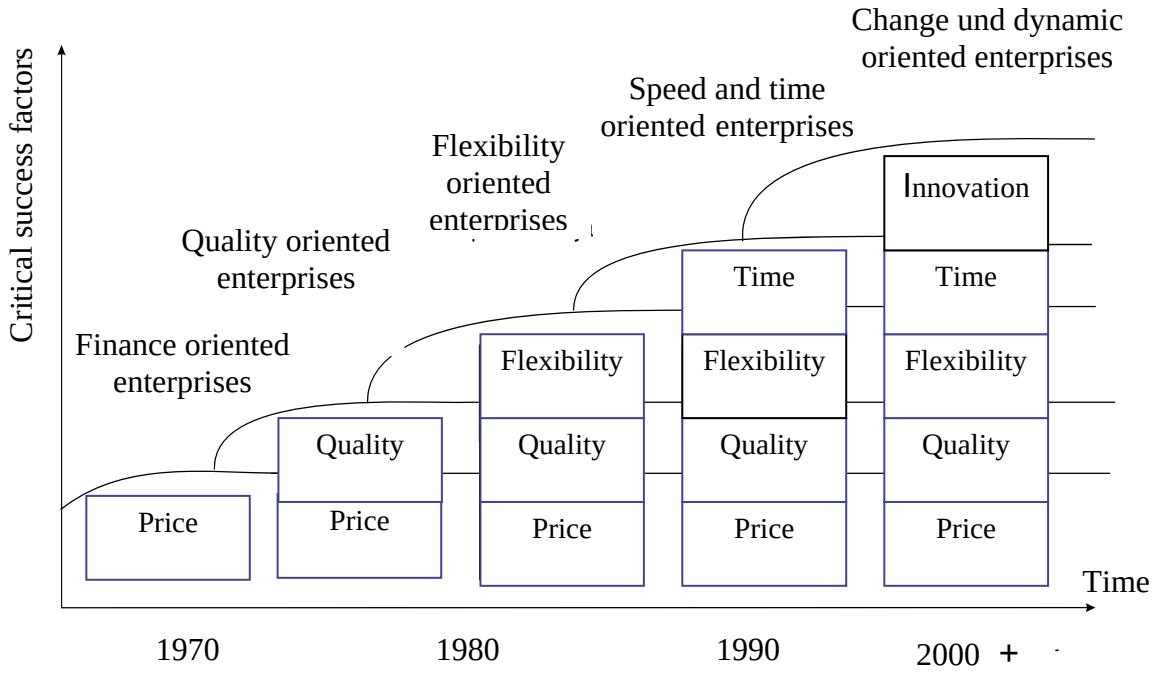


Figure 1 *Increasing requirements for enterprises*

Continuous success is accomplished by the enterprises which both optimize their business processes and identify/penetrate into new markets. Numerous enterprises are looking into different manners of achieving these objectives, with many of them striving to maintain and further optimize their core competencies, while outsourcing the strategically

insignificant competencies.

In shipbuilding, like in all other market sectors, success is based on knowledge.

Also the influence had these processes to shipbuilding industry world-wide (also in Europe and as soon as Croatia).

2. European shipbuilding industry

Europe is the only part of the world with a dense network of shipyards, equipment suppliers, research centers and other engineering services. LeaderSHIP 2015 addresses the EU's long term strategy for economic, social and environmental renewal brought forward in 2000 by the Lisbon Council.

The key elements, contained in the strategy, on which LeaderSHIP 2015 gives recommendations, are:

- Increased R&D investment with a target of 3% of GDP;
- Improved access to finance for business; and
- Lower regulatory burden and the attraction of young people to industrial jobs in an enlarged Europe.

Key data of the European shipbuilding industry are summarized below:

- Annual turnover of EUR 34bn, more than 50% being exports;
- Network of over 9.000 companies that employ 350.000 people;
- Strong global market position in ship repair and complex vessels.

Summary of problems and recommendations includes:

- There is a persisting imbalance of supply and demand due to state supported strategic investments in Asia that resulted in overcapacity and subsidies (shipbuilding being the only industry without protection against unfair trading practices).
- The recommendation is that an international shipbuilding agreement on the OECD level should be made, as well as the full enforcement of applicable WTO rules to shipbuilding.
- The key to compete internationally is through research, development and innovation (RDI), not through low costs. Knowledge creation in shipbuilding, i.e. prototype development, is not adequately supported.

- The proposed solution is that shipbuilding should enjoy the same conditions as other industries that engage in similar activities and the industry RDI should be strengthened by integrating efforts to create Technology Platforms.
- Shipyards are not well suited for organizing the financial parts of capital intensive shipbuilding projects and a number of commercial banks are moving out of ship financing, while non-EU competitors rely on state supported financing instruments.
- The key is to establish an EU-wide guarantee fund for pre- and post-delivery financing, and to have credit insurance companies offering hedge instruments to cover currency risks.
- Problems with safety of the environment by allowing substandard vessels entrance to the EU waters. The system for investigating the quality of design and construction needs enhancing.
- The recommendation is to make a quality assessment scheme for shipyards at an international level, to promote a more transparent technical survey of vessels and to implement future EU legislation at world-wide level. An expert committee will be established to help the European Commission and the EMSA in this task.
- European naval shipbuilders do not work together and thus cannot be globally competitive, which is further troubled by the absence of a truly common market for defense equipment.
- LeaderSHIP 2015 advises to establish common rules with the aim of creating a European market for defense equipment and enabling interoperability of systems leading to co-operation between yards.
- The industry's culture for the protection of intellectual property rights is insufficiently established and there are many stages of the shipbuilding process where information leakage can occur.
- To solve the problem of the shipbuilding industry, its international patent rules need to be strengthened and IPR protection exploited to the maximum.
- The industry nature is changing at a fast pace and exchange of know how across Europe is limited.
- The proposal is to exchange know how and staff at all levels and to establish regional centers of excellence to teach new skills.

- EU enlargement will create additional needs for industrial consolidation which should be facilitated by the EU, providing incentives to remove less efficient capacity and free resources for new investments.

3. Current situation in Croatian shipbuilding industry

3. 1 Shipbuilding potentials

In approach to this subject, it is necessary to specify the following initial assumptions (Sladovljev, 2002):

- Ship is a final product of the shipyard, yet it contains all sorts of products characterized by high degree of a final processing of the supporting industry and various handicraft trades.
- Ships as well as the other products of the shipyard present its capital objects thus having their significant multiple impacts not only on the entire region's economy but also on the economy of the Republic of Croatia as a whole.
- The Croatian shipbuilding industry, taken as an extremely export activity, may have a significant effect on the country's positive commercial balance sheet. The efforts of making the national naval architecture's business network stronger and the increase of domestic component in the ship's value structure consequently influence a growth of indirect export realized through a ship as the final export product.
- The world practice recognizes the shipbuilding industry as an intense work industry.
- Through the Croatian shipbuilding industry is introduced with the international standards of quality and business, therefore promotes its technological development as well as its own human resources in a various scientific and professional levels.

It is worth to point out that all previous theses have contributed a lot to the importance and significance of the shipbuilding industry, and therefore should be considered in the context of a cranky and demanding world's naval architecture market, including its great and cyclical changes of supply and demand.

The contemporary Croatian shipbuilding industry is represented by five (5) big shipyards. Their basic references are shown in the Table 1 and ownership structure in the Table 2.

Table 1 *Basic references of the Croatian shipbuilding industry*

	Uljanik	3. Maj	Brodosplit	Brodotrogir	Kraljevica
Average number of employees	1.911	2.286	3.593	1.283	570
Revenue (mill. HRK)	1.365	1.050	1.798	729	251
Export (mill. US$)	188,9	125,0	162,5	87,5	0

Table 2 *The ownership structure in the Croatian shipbuilding industry (2005)*

	Uljanik	3. Maj	Brodosplit	Brodotrogir	Kraljevica
The State	84,76	83,31	99,78	95,12	99,46
Small shareholders	12,28	14,31	0,00001	4,37	0,00013
Others	2,96	2,37	0,22	0,52	0,54
Total	100	100	100	100	100

In addition to the above, the following companies are actively operating: the Brodosplit-Brodogradilište specijalnih objekata (shipyard of special vessels), the V. Lenac (declared bankruptcy), the Tehnomont Pula, the Leda Korcula, the Greben Montmontaža Vela Luka, the Lamjana Uglan, the RBŠ Šibenik, the Lošinj Mali Lošinj, the Punat Krk, the Betina Murter, and a number of smaller shipyards.

The Croatian shipbuilding industry participates with cca 2% in whole world industry and holds fourth position (Figure 2). Figure 3 shows ships delivered of the Croatian shipbuilding industry in period from 1994 to 2006 (2009) in million US$.

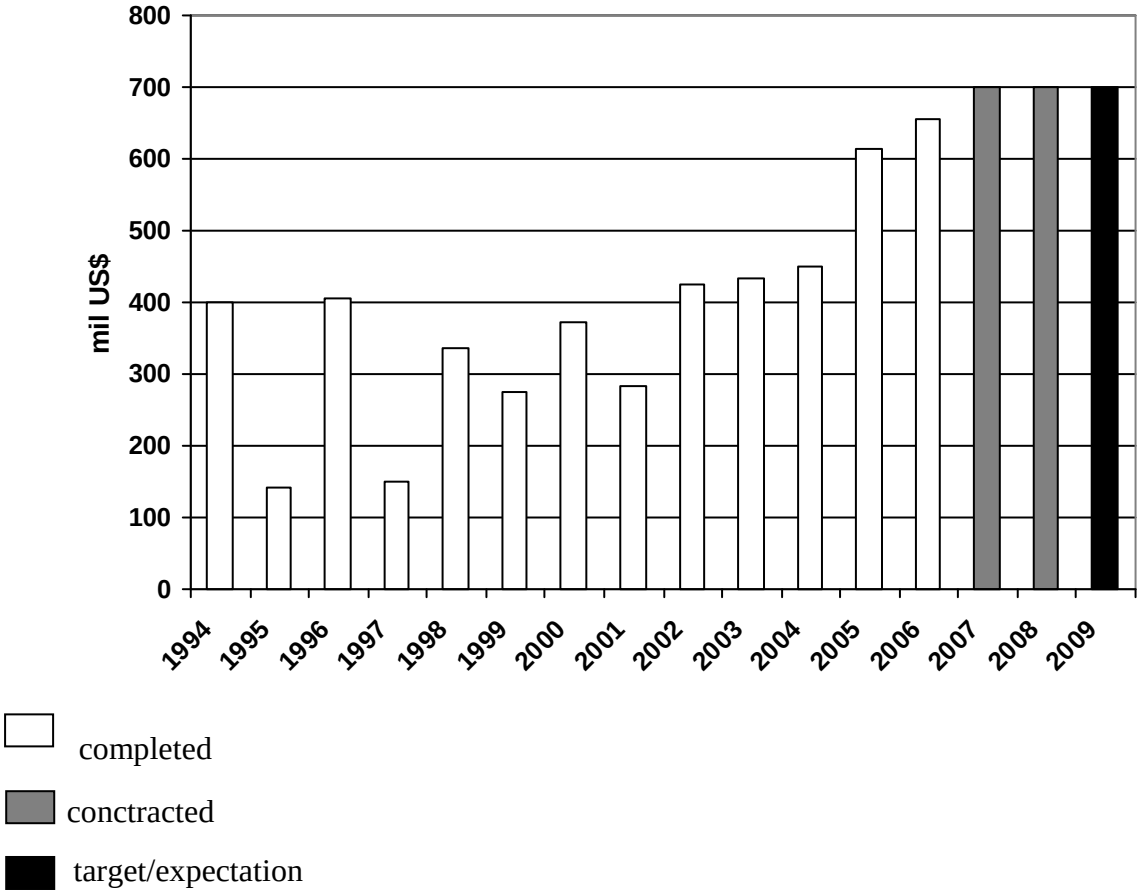


Figure 2 *Ships delivered of the Croatian shipbuilding industry 1994-2006 (2009) in million US$*

Present production range of the Croatian shipbuilding industries:

- merchant ships up to 170.000 dwt in one piece,
- bulk carriers,
- product carriers,
- chemical carriers,
- car truck carriers,
- asphalt carriers,
- live stock carriers,
- cable layers,
- car passenger ferries,
- yachts,
- reefers, etc.

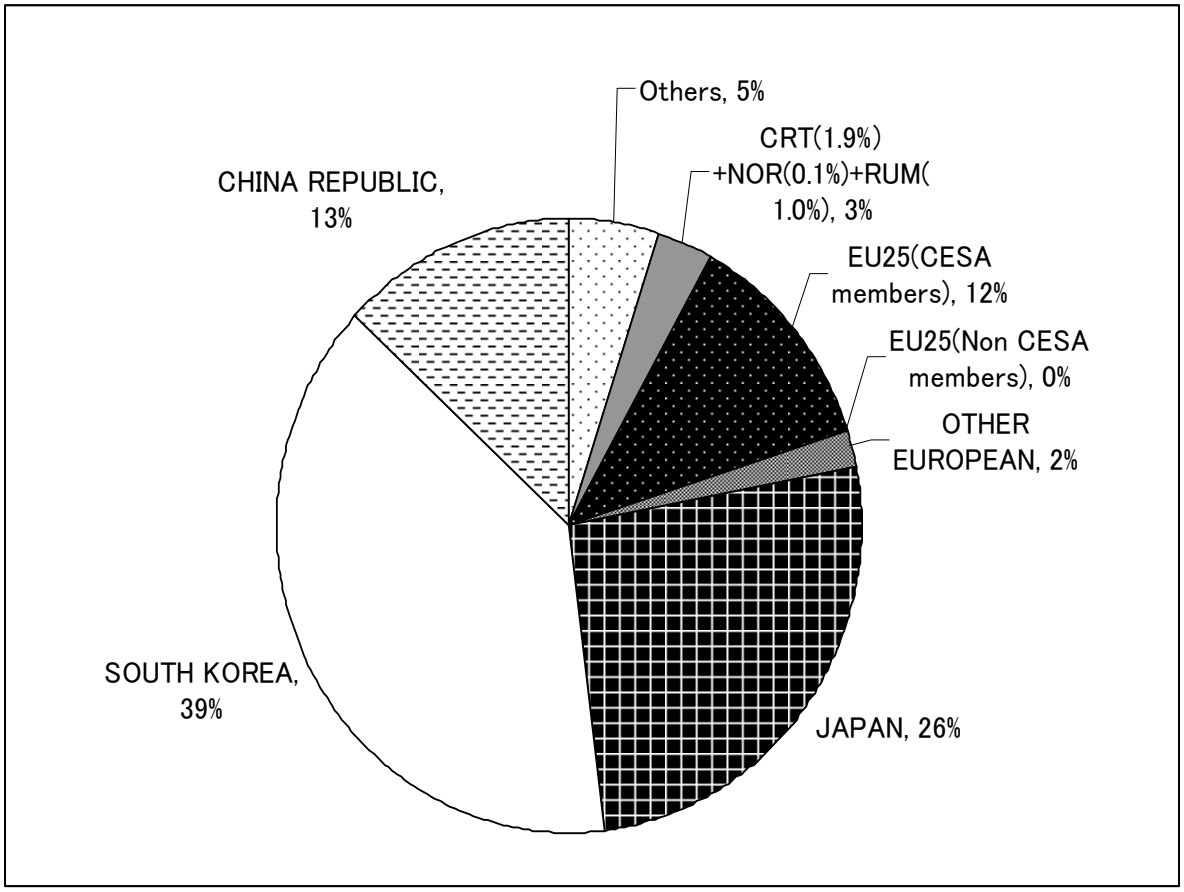


Figure 3 *World order books at 30.09.2004 (81.703.100 cGT)*

Produced not only inside the shipyard:

- main & auxiliary diesel engines,
- marine equipment,
- ship repair & conversion,
- special & naval vessels.

3.2 Macroeconomic impact of shipbuilding industry

By its primary economic effects of shipbuilding industry has been known to be a low-profit activity. However, due to its multiplier effects for national economy, in terms of income, employment and foreign currency balance this industry is extremely important. In addition to this, taking into account relevant assessment criteria, this economic industry is entirely globalize.

Share of domestic substance in a single constructed ship depends on the exchange rate and price ratios. In the last few years this share has remained at the level of 60 - 65%. It ensues from this data that, with a potential annual production of $800 million the share of domestic producers of the ship's components accounts of $400 - $440 million.

According to the latest evaluations multiplier factor of shipbuilding industry has been set to the value of 2.83; so, with a potential annual production worth $800 million domestic expenditure of $2.264 million could be realized. In addition to aforementioned the shipbuilding industry contributes to the stability of the market. It also bears a significant social component as it directly employs some 12.000 workers and 5.000 subcontractors while 180 companies in the European Union, producing the ships' equipment employ approximately 26.000 employees. The percentage of the production employees in the shipbuilding industry in the Republic of Croatia accounts for 8% of the employed. Finally, with such export rate the shipbuilding industry accounts for 10 - 15% of the total value of the country's deficit in commodities.

As regards shipbuilding industry the country's financial balance will remain negative for the next four years. However, within the frame of income-expenditure account, with subsidies, recovery and loss coverage in expenditures and taxes, surtaxes and contributions in income, this balance is balanced and stands at about the value of $300 million.

3.3 Restructuring and privatization

In economic practice restructuring and privatization are understood as unique procedures meant for enhancing competitiveness of a single economic subject, branch, group or overall national economy. Economic and social analysts differentiate among these processes by their content and function, whereby restructuring is defined as permanent and universal process and privatization as the process of replacing state ownership with private ownership. As general, global trend, the privatization gained momentum during 90-ties in the last century, which coincides with the adoption of liberal practice as a dominant one. In the so-called transitional countries, privatization is comprised as a revolutionary act directed towards ideological and systemic changes of the widest social and economic content. From an organic point of view, and due to the aforementioned, restructuring has a priority over privatization. However, according to the prevailing liberal standing it can not reach the objective of strengthening competitiveness without a private motive or interest. Experience has shown great synergic effects of both procedures in the conditions of high market

articulation of the system whereas the lack of this characteristic inevitably lead to failure, i.e. the lack of this feature results in the lack of success. In line with this, many examples in practice have shown good results in smaller organizational systems while in larger organizational systems the results are generally modest. For this reason, the standing prevails more and more that during the privatization of large systems the restructuring must precede the process of privatization, i.e. for the inevitable role of the countries in such systems a certain degree of control should be assured, i.e. its permanent ownership status. The described principle has been confirmed in a number of countries and undoubtedly represents an acceptable possibility also in the case of the Croatian shipbuilding industry.

3.3.1 Restructuring

The term restructuring, taken as a concept in a narrower economic sense, represents repositioning within the frame of new technological, organizational and economic concepts. Moreover, the restructuring should be considered as a permanent, i.e. never ending process which is measured and realized by phases. However, in the context of a criteria matrix organized in this way, there are entire periods, even epochs, which have determined the long-term restructuring, processes, for example big technological, economic and geopolitical changes whose conceptual dimension determines in terms of objective, method and materially these processes.

More serious development in the field of restructuring were recorded in the recent history, in 70-ties and 80-ties of the last century in global shipbuilding, i.e. at the very end of the process of general industrialization which has lasted intensively from the half of XIX Century. This phenomenon has been generated by the position of global competitiveness and which in turn, triggered the price of manpower, as in shipbuilding industry the production was still relatively work intensive Namely, as technology has become more and more universal and subtle, the price of manpower started to play a decisive role with regard the reallocation of capital. The price of manpower includes also the costs of the state and public sector and social welfare.

Along with this process, specialized production has started to develop and here, manpower price was losing its role in favor of the specifics of the production program and within the frame of it, to intellectual solutions and innovations. However, in the course of the described process the solutions have not been placed alternatively but have been deduced by

criteria from a number of factors or organizational and financial nature and resulted in the choice of orientation in the given time period.

The development of shipbuilding industry from the early 90-ties of the last century has taken two directions in terms of the space, geography and technology. On one side, the producers from Far East took almost the entire production of serial cargo ships based on the *zaibatsu* technologies and organizations, while the producers form Atlantic oriented their production towards specialized products. The restructuring of the Croatian shipbuilding industry has also started in 70-ties and 80-ties of the last century, just as in more developed industrial countries. However, the process itself was facing special restrictions, the biggest part of them being those related to socio-political environment and related organizational references and geopolitical issues, while the market factors have had somewhat less restrictions.

Namely, in that period still within the Ex-Yugoslavian, the Croatian shipbuilding industry was within the context of predominately bilateral relations with the markets of the so-called countries in development and clearing markets which guaranteed the good positioning and competitiveness.

On the internal market the shipbuilding industry was systematically strongly integrated in general economic matrix so it has worked as a large system of transferring the value whose final price was determined, due to export, by a foreign currency component and system of exchange rate ingredients. Huge system could not have been partially changed, which as a consequence disqualified in advance all reforms and restructuring in the shipbuilding industry. It is logical that such an environment has fatally slowed down the restructuring processes just in the period when they started by a fast pace in global shipbuilding. Another reason of limitations which was determined by Yugoslavian economic matrix and its external economic orientation was the so- called political and economic system of self-government which functioned as an expression of wider reproduction units, which in turn have meant total balance of horizontal –vertical ties in the area of economic, social and political system. Such systematic feature have led to a hypertrophy of the contents of the companies which have integrated ale with the aforementioned economic and numerous non-economic contents which still burden the Croatian shipbuilding industry. In short, the economic system characterized by self-sufficient contents and the inert system of hypertrophied economic and social characteristics, together have contributed to the slowing down of the processes of restructuring the Croatian shipbuilding industry during the 80-ties.

By declaring sovereignty and transitional changes the Yugoslavian system of foreign relations and internal ties has collapsed. Soon after that Croatia was attacked and this has put the shipbuilding industry in a dead-end situation. The period of occupation of large areas of our country expelled the Croatian shipbuilding industry from the global market which was only one more reason for lagging behind in the restructuring process. A gradual stabilization of economic and political situation has started only after 2000.

3.3.2 Privatization

According to general understanding of the term privatization, the privatization accelerates the process of restructuring, enhances business efficiency and strengthens competitiveness. The effects of privatization within the frame of the restructuring process are therefore synergic. Due to this in transitional countries the restructuring and privatization processes are tightly linked and considered as almost equal. Until recently, the prevailing opinion has been that the restructuring of shipbuilding industry is not possible to implement without its previous privatization.

Of course, this opinion is entirely wrong, since, as it has been said, the privatization brings exclusively a synergic effect, which has been proved by a number of successful privatizations whose restructuring effects totally failed. In privatization the buyer and seller appear with their motivations of maximizing the effects. However, unlike the concentrated market effect when the market-based criterion is exclusive in the case of shipbuilding industry and industry of big capital values and multiplicative effects, privatization confronts a private buyer of narrow business interest on one side, and the state with wider economic, social and geopolitical interests on the other. Due to this, the effects of market optimization are here very complex. The buyer, the private investor is concentrated on the relation between the price and expected gains, whereas the seller, the state, on resolving complex economic and social problems. Problems which the state is facing are linking the issue of values and multiplication in the area of employment, income and foreign currency effects; also, it contains often numerous mortgages for the past as are debts, unsettled financial liabilities, obsolete technological and organizational concepts which all together must be solved by the seller and the buyer in the process of privatization.

Lack of study and lack of will to elaborate all these issues and problems most often results in the simplification in the process of evaluating effects, which in turn generates

misunderstanding, conflicts and finally contra productive solutions both for the buyer and for the seller. In general, it can be concluded that the process of privatization must be subjected to and evaluated from the positions of the process of restructuring. Therefore, the restructuring must be strategically broadly designed and not narrowly, exclusively tied to business purpose of the moment or the State current problems, i.e. solved hastily.

4. Case study of restructuring: the Brodosplit Shipyard Company

The "Brodosplit" Shipyard Company was founded in 1922 by merging of few minor shipyards in the area of City of Split. It was on the current location since 1932, although the tradition of ship building in that area is much older. Very significant development and building of larger ships has been recorded in 19th century. The "Brodosplit" today is a joint stock company that is owned by the Government of Croatia and has more than 3.500 employees.

The Brodosplit shipyard's business experience up until now can be shortly characterized as following:

- business with loss,
- low productivity,
- cost oversize out of contract's calculation, specially process costs,
- significant share of cooperation's working hours in comparison with a total capacity of the shipyard,
- low degree proportion of its own capacity in construction work,
- high degree proportion of cooperation causes its fixing the costs and terms,
- losses of its own production's capacity in work hours in a regular working time,
- delay in terms of delivery,
- great number of changes, even in a repeated construction works,
- high proportion of failures (documentation failures, failures in technology, materials, etc.),
- low degree of equipped sections before the embedding,
- insufficient number of high quality workers in key professions,
- functional organization structure with elements of project organization,
- absence of consistent model in cost management,
- great dubious inheritance from the past.

On the other side, small economy of the Split-Dalmatian County dominates not only in number but also with its increasing participation in the basic economic parameters:

- it is organized in more than 99% of the total number of economic subjects,
- it employs more than 67% of the total employment of the County's economy with a tendency of growth,
- it also realizes the highest level of total income, with more than 2/3 of the total County's economy income,
- it still presents the only part of the County's economy that makes business with net profit (total profit is greater than total loss.

Taking all mentioned points into consideration it is to conclude that small and medium-sized businesses are significant and relatively the most successful subjects in the economic development of the Split-Dalmatian County.

Nevertheless, it is obvious that there is a great potential and possibility for the increase of proportion of domestic component (material inputs) in ship's architecture. At the same time, this implicates that there is a possibility of significant increase in exploiting existing capacities as well as in founding a new productive capacities in this segment of economy. That is also a chance for development of small and medium entrepreneurship not only in the region of Dalmatia but in Croatia as a whole and it will definitely contribute to the development of Croatian building industry small economy subsystem.

This paper presents a concept of restructuring and adjustment of the Brodosplit and a total shipbuilding industry activity in the Split-Dalmatian County, with all requirements from the environment, stressing the importance of consolidation of broader ship building business system and its impact on the development of the County's small economy.

4.1 Modular shipyard design

Due to a quite complex situation in the naval architecture's segment of world's market and aiming to survive, shipyards make their efforts in using the potentials in order to apply rationalization and to increase flexibility. Reducing the costs, adjusting it to the various needs of buyers and promptly reacting on a cranky environment demands, present the elements worth to take into consideration and to focus on. Therefore, the Brodosplit is trying to optimize its core competencies and to realize modular shipyard concept. Modular shipyard, beside all, implicates maximum harmonized structure of buildings and facilities, as well as logistic and organization, in order to achieve higher competitiveness and to approach the

shipyards the "Best-in-Class". According to analysis the greatest possibility of saving offers the level of organization and the one of product/production design.

However, besides the investing in modern technique (devices, cranes, procedures), and a change of the organization's structure, it is necessary to ensure efficient use of all employees' potentials.

In order to ensure successful business activity in the future, the staff is expected to meet the following demands: competencies to resolve problems, systematic thinking (teamwork), and intelligent work. Introducing teamwork in the working processes in a sense of buyer-supplier relationships as well as in the managerial structures defining the goals and tasks, teamwork should be therefore, implement in the entire shipyard.

To realize modular shipyard project it is necessary to determine core competencies (Prahalad & Hamel, 1990) in the Brodosplit, which will continue to take place inside the shipyard and to point out the steps for their improvement. On the other hand, already mentioned, so-called standard capabilities which are not so essential for the Brodosplit, have to be put apart as small and medium-sized companies connected in the same network (outsourcing).

ARIS methodology (Sheer, 1999) has been used to present the Brodosplit's business processes. It enables graphic presentation of business processes trough developed software on four levels:

- organization (workplaces),
- functions (performance of the activities),
- resources (basic means, documentation, material, and the like) and
- production program.

4.2 Modular shipyard characteristics

Basic characteristics of modular shipyard are as follows:

- enables fixed costs minimization,
- performs basic business, projective and engineering functions, composition, testing and receive-deliver tasks,
- all other tasks carries on cooperative shipyards through the system of participation in common product,
- chooses partners from near but also from the wider environment,
- establishes partnerships on a base of quality of components and services, price

competitiveness, warranty on the terms of delivery, agreed ways and conditions of payments with the participation in business risk,

- bears entire responsibility towards ship owner and classification's company on the basis of an entire contract and ship's quality, in a whole, as well as in specific areas, and agreed the terms of delivery,
- coordinates work of its own and cooperative facilities,
- insures close relationships with all participants in process, by long-term agreements and contracts,
- purchases materials and equipment upon optimum conditions,
- insures partners in different phases of construction, with different productive profiles and different forms of ownership,
- supervises and controls results of partners work, and indirectly affects their working process,
- puts up, if possible, process or team organization in functional organization's structure.

4.3 Determination of core competencies inside the modular shipyard

Several meetings were held between the partners on project and responsible experts from the Brodosplit, which led to the analyses about basic activities that can be taken in modular shipyard and also other activities that can be done in small and medium-sized companies. Rough plan of shipyard's organizational restructuring into a type of modular shipyard is shown in Figure 4. It brings principal suggestion of the activities that may go inside modular shipyard and also the activities inside small and medium-sized companies that would be connected with modular shipyard.

However, it is necessary to pay attention to the potential limitations in the implementation of shipyard's new organization concept based on "core business", and also in extracting the individual organization's units into the independent companies. The mentioned limitations are potentially connected with different areas of business process organization: market, technology, human resources, finance, and the like. That is why, the only possible approach in the process of the Brodosplit Group organizational restructuring, that can be taken by a specific, individual evaluation and elaboration of market's and other potentials for each organization's units, predicted for extracting and independent business activity, but still holding on the further significant participation in the entire naval architecture business system.

Extracting process of each of organization's units needs to be based on realistic

criteria which will grant, on one side, their durability as independent commercial company, and on the other side, long-term and stable service-providing of this unit to the modular shipyard Brodosplit. In that context, it is necessary to observe all segments of re-organization and restructuring process, primary in terms of today's facilities, but also in terms of connections and relationships with, in the future, also re-organized and restructured modular shipyard.

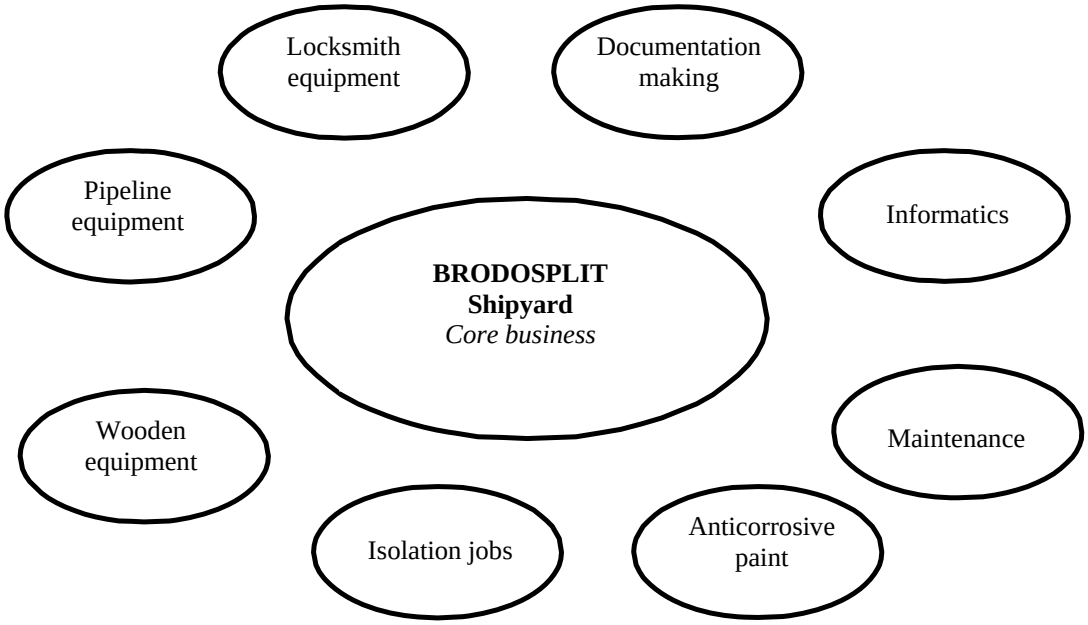


Figure 4 *Basic activities suggestion within the modular shipyard Brodosplit, and small and medium-sized companies*

It is obvious that the process of extraction, restructuring and adjustment of individual organization's unit to the market's conditions, will demand several steps to be made: increase of capacity's utilization degree, apropos productivity increase; reduction of failure's proportion, adjustment of organization's structure and the increase of efficiency in business activity organization (especially preparation phase) in new conditions including the possibility of rationalization according to the results of analyses and separating processes or parts of processes that "stays" inside the modular shipyard. On the basis of re-organization and restructuring, it will be necessary to revaluate costs of performing tasks of each individual organization's unit, but also the costs of external support and today's common services, keeping in mind the possibility of independent organization of some functions or the possibility that some services of the modular shipyard to a single organization unit

compensate with cheaper services from external environment, and so the like.

In the second phase, organization's units separated in this way will be connected with the companies inside and outside the Split-Dalmatian County (Figure 5).

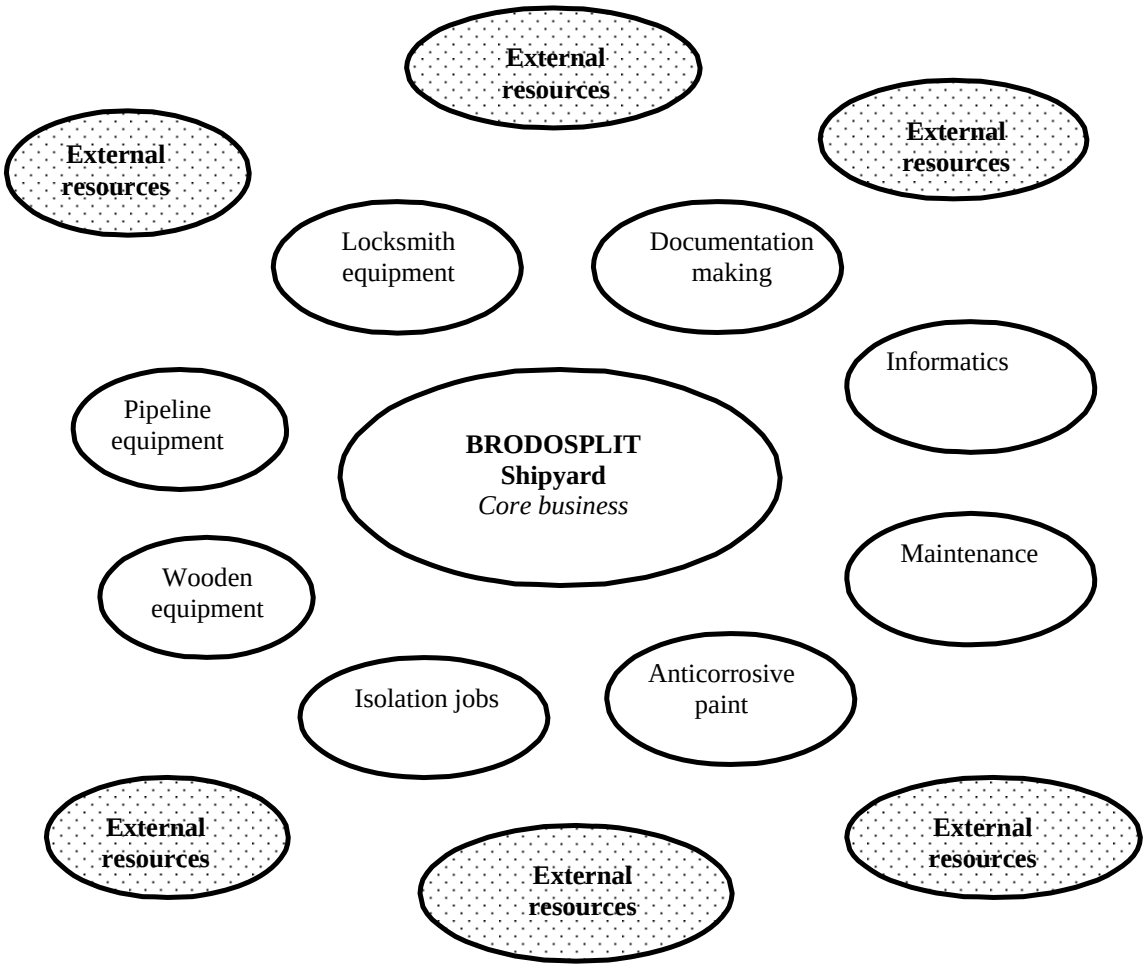


Figure 5 *The Brodosplit-Shipyard relation concept with external resources*

5. Shipbuilding cluster of the Split-Dalmatian County

It is to conclude that shipbuilding industry presents the key and strategically the most important industry of the Republic of Croatia, and already having its Croatian brand, it should soon become a «locomotive» of development other branches of industry, especially of small and medium-sized companies. In order to increase the shipbuilding competences the integration of all productive, service providing and scientific activities closely related to the shipbuilding industry the Split-Dalmatian County is required. Such integrated shipbuilding system would have *cluster* characteristics, focusing on mainly on the increase of competence

of the existing shipyards in the area as well as their supporting industries that would participate in ship building. Organized like this, such shipbuilding cluster of the Dalmatian region would further join the shipbuilding clusters of other regions (especially of the Kvarner and Istria), and therefore increase the industry on the national level.

The concept of shipbuilding cluster is shown in Figure 6. The concept presents on one side the associate relationship of schools and universities and on the other side the shipbuilding industry of the Split-Dalmatian County. The main factors or rather activities that can be done through the presented network are shown as well. Further, the figure of the main elements and activities of cluster shipbuilding is presented too.

a) Schools and universities would participate in fundamental and continuous education of cluster shipbuilding staff. Educational plans and programs could be determined and agreed according to the needs of various professions of cluster shipbuilding employees.

- technical high school,
- bachelor's degree studies,
- master's and PhD degree studies,
- specialist studies.

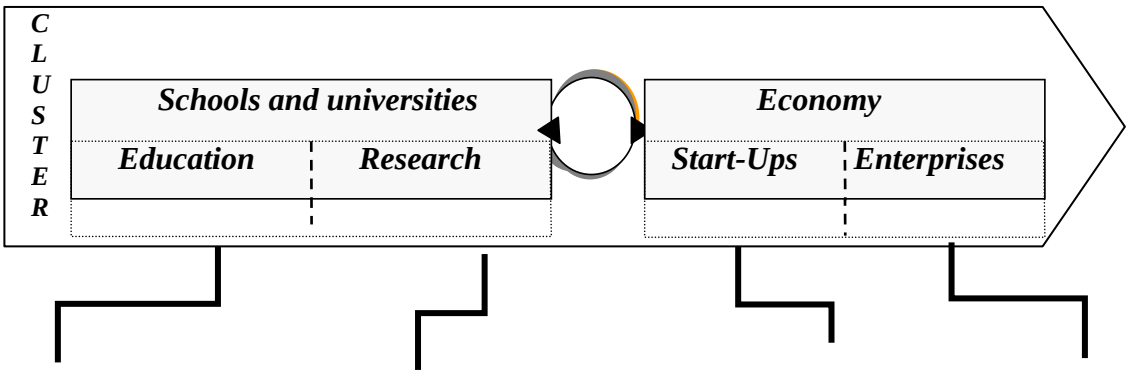
b) Schools, universities, scientific-research institutions would cooperate in developing new products and processes as well as in improvement of the existing ones.

As the structure of the developing function on the level of cluster shipbuilding of the Republic of Croatia is quite relevant to the subject, the suggestion of such structure is given below. So, the final structure of the developing function would be made according to the previously determined cluster shipbuilding on the level of the Republic of Croatia.

The structure of research-developing function would aim to develop the product itself as well as production.

- *Product development* would be based on the concept of developing centers associated with the main developing headquarters at the Shipbuilding Institute of Zagreb and the Croatian Shipbuilding – Jadranbrod.

  The task of this developing function would primarily include planning, researching and development of new projects, types and categories of ships according to the world trends, but also its would refer to its own researches and market needs, applying new materials, technologies, methods and procedures on the basis of the common interest.



Schools

University of Split (Bachelor's and Master's degrees diplomas)

- Mechanical engineering,
- Electrical engineering,
- Naval Architecture.

A variety of research institutions

Start-up

Shipyards in Split-dalmatian county

SME

plus a variety of shipbuilding related engineering services providers

Figure 6 *The cluster shipbuilding*

- *Development of technology, organization, methods and procedures*, would rely on the concept of connection of the regional developing services with faculties dealing with technological and organizational researches, as well as with the one of Industrial engineering in an individual shipyard.

The task of this service would include the monitoring, assessment of demands and possibilities of new technological and organizational achievements in order to improve production and productivity, technological procedures, organizational improvements, introduction of new materials, machines and tools into production and the study of work and time.

The Croatian Shipbuilding - Jadranbrod would present the headquarters; the Shipbuilding Institute in Zagreb would stand for the main developing and researching center whereas the individual modular shipyards would figure for the regional researching centers (the Uljanik, the Brodosplit, the 3. maj). Faculties would take a role of a consulting and cooperating bodies with their studies of naval architecture: the University of Zagreb - the Faculty of Mechanical Engineering and Naval Architecture, the University of Split - the Faculty of Electrical Engineering, Mechanical

Engineering and Naval Architecture, the University of Rijeka - the Faculty of Technical Sciences.

Researches would imply teamwork expected to be performed in two ways:

- Researching projects agreed with the Shipbuilding Institute and the Croatian Shipbuilding - Jadranbrod.
- Own researches and development not only of new products but also present technologies, following and applying world achievements in our shipyards.

Approaching in this way all preconditions for the encouragement of innovative work would be realized. Organized in such way scientific and research work would achieve its final goal that is, promotion and holding of its "domestic brain", acquisition and usage of new know-how, projection of a new, sophisticated classic ships as well as vessels of the "new generation"

c) Newly founded («Start-up») enterprises. According to the analyses of the National Council for the Competitiveness in Croatia, the rate of newly founded enterprises is quite low and the structure of an enterprise is such that it rather show low rate of potential growth as well. Consequently not many working places are offered in this way. Therefore, stimulating environment for entrepreneurship is suggested in order to increase the number of working places that is the growth of *TEA index*[1]. The goal is to increase TEA index from its present value 3,6 up to 10.

Structuring of cluster shipbuilding would lead to the preconditions for generating new entrepreneur ideas relating to a ship or shipbuilding business production process. The cluster shipbuilding would buy products and get services for its high-tech activities from domestic and regional providers. The further step of these high technology oriented „start-up"enterprises would be realized through their integration and network.

It is to conclude that newly founded enterprises based on knowledge and innovation would strongly support the development of the industry of the Split-Dalmatian County.

d) Enterprises. The cluster shipbuilding would consist of: «big shipyards» that is the modular shipyards, "small" or „sub-contracting" shipyards and small and medium sized enterprises of the County, service providing enterprises on the basis of their participating role in production of common product or their partnership. Such teamwork and their own products/services would evidently increase the proportion of domestic component of ship.

„Modular shipyards", having their own resources and capacities to produce

[1] TEA (Total Entrepreneurial Activity)

component parts (tracing, cutting and forming) they could, if necessarily, make cutting and forming activities, so that the produced components could be transported to the small shipyards where the hull sections and equipment could be done, according to the given standards. Upon finishing, equipping and dyeing, the elements would be transported back to the modular shipyard in order to grow into a „ring“and /or assembly (prefab) slipway. Such fitting, equipped and dyed sections would be built into basic structure on the slipway.

Shipyards as sub-contractors, having their basic resources and needed skills such shipyards would, consider their participation in common product; deal with works related to a specific ship and would be purposely specialized for it. Free productive capacities could be sold on markets of shipbuilding or other markets.

Small and medium-sized enterprises in the Split-Dalmatian County. According to the analyses presented in the article (Veza & others, 2004) small and medium-sized enterprises of the Split-Dalmatian County have enough potential for taking their part in cluster shipbuilding. The data relating to their importance for the national economy as well as their involvement into industry are presented in Chapter V of the Article entitled „55 suggestions for the increasing of competitiveness of Croatian economy“, significant growth of small and medium-sized enterprises (suggestions from 34 up to 41).

Enterprises providing services. These types of enterprises could be also involved into cluster shipbuilding, especially enterprises dealing with the projects, construction, consulting, marketing, and financial services etc.

The advantages of such structure of cluster shipbuilding would be as follows:

- More qualified division of work, implying easily performed redistribution of work force in critical phases of shipbuilding – on the take and return base inside cluster.
- Increasing of the responsibility in general, concerning the terms for „budget“ and quality, or the most important the responsibility of realization of project and agreed productivity,
- Granted jobs for all employees, participants in making common product.
- Bargains and unfair practices eliminated
- Decrease of needless costs and their control
- Detailed and qualified monitoring of a complete process of ship production as well as of terms fulfilled from the same location,

- The existing staff, decreased in number and presently employed in different locations would be connected through their profession and expert orientation.
- Increase in flexibility of workers' deploying and disposing of means of production,
- The possibility of more qualified informatization and rational investment
- Increase of productivity or rather a decrease of effective hours/cGT,
- Involvement of greater number of producers, especially those from distant regions, into common product,
- Increase of employment through opening new working places (start-up enterprises),
- Quality would fit to the real costs and prices,
- Realization of aimed investment and parameters of production, each in its field of work,
- The possibility of introducing developing function, which has been „ignored“ for more than ten years and challenge of dealing with more sophisticated products such as merchant ships and passenger ferries of a new generation.

6. Conclusion

The processes, which we are dealing with in this paper, are accompanied by huge social and economic changes as well as changes in mental structure, which can not be, as experience has shown, jointly resolved by ideological and political determinism by polarizing the roles of the state and the market. The solution is to link market and profit to the relevant strategic determinants of the national economy and the society as a whole. Namely, the issue of the shipbuilding industry cannot be addressed and resolved in isolation, neither as a business system nor as the state-social value complex. It should be considered as an economic, social, and political issue of the primary importance and, in line with this, the solutions should be found within the framework of the widest and most inter-dependent market, national, and social references.

Parallel to the previously elaborated organizational reengineering, it will be necessary to raise the technological level by investing in new equipment. This is especially significant because old equipment may impede the efficient, transition to the modular shipyard model. Old equipment causes greater costs in technological and production processes as well. It is also worth pointing out that the same effect will be achieved in 15 times greater investing in equipment compared with the changes in organization's structure.

After organizational and technological restructuring the final and measurable objective would be to achieve an annual gross profit of $320 - $350 million. This could be done progressively, in the following two phases:

Phase 1: achieve annual productivity of 7-8 ships (from today's 4-5 ships), which means 110 days/ship on the slipway, or 40 Wh/cGT[2], or annual gross income of $200 - $250 million.

Phase 2: achieve annual productivity of 10 ships, which means 75 days/ship on the slipway, or 30 Wh/cGT, or annual gross income of $320 - $350 million.

Shipyard restructured in this way would have much greater competitive capability. In this way a concentration of individual production's processes/services would be achieved and with a synergic effect this would include increased competitiveness of related companies and more chances for their survival on today's cranky-increasing market.

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[2] Wh – working hour, «cGT» - compensating Gross Ton

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