THE SHIPBUILDING INDUSTRY IN ITALY: AN OVERVIEW

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ABSTRACT
This paper summarizes the main results of a research project about the economic organization and the financial structure of a large sample of companies (a thousand limited companies) of the Italian shipbuilding industry. Export characteristics have been analysed, too.
Shipbuilding is a complex industry, with high heterogeneity of products and technologies, and a labour organization mainly based on a pyramidal supply chain that is localized within industrial districts. Balance sheet ratios show a robust financial structure, as well as good production dynamics, mainly thanks to a high export intensity. Results suggest good opportunities for the Italian companies to recover from the 2020 economic crisis caused by the covid pandemic.

KEYWORDS: shipbuilding industry, industrial districts, exports.

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1. INTRODUCTION

At CNR-IRCrES we deal with economic studies about the most significant sectors of the Italian economy, such as automotive, textile, industrial machinery, fine chemicals, pharma (Calabrese, 2002; Rolfo & Calabrese, 2006; Calabrese & Vitali, 2007; Calabrese, 2009). The shipbuilding industry is one of them.

This paper summarizes the main results of a research project about the shipbuilding industry in Italy, shedding light on its economic organization, financial structure, and export characteristics.

Shipbuilding is a complex industry, with high heterogeneity of products and technologies, and a labour organization mainly based on a pyramidal supply chain that is localized within industrial districts.

We collected a sample of a thousand limited companies, with their balance sheets, economic performance, and financial ratios, in addition with a micro-economic database of Italian exporting firms to analyse export dynamics and intensity. The 2019 balance sheet ratios show a robust financial structure and suggest good opportunities for the recovery from the covid economic crisis.

The remainder of this paper is structured as follows: section 2 describes the labour organization of the industry and its supply chain, that are determined by technology, core product, and company strategies; section 3 deals with the balance sheet analysis of a thousand limited (ltd) companies in the 2017-2019 period; in section 4 we consider the export data, in terms of destination countries and concentration ratios, at country level as well as at company level; some conclusive remarks and policy implications are in the final section.

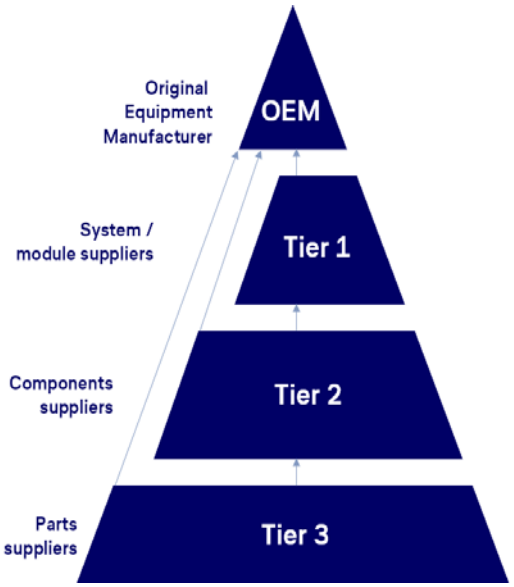
2. LABOUR ORGANIZATION AND SUPPLY CHAIN

Within the shipbuilding industry, there is both a high heterogeneity of products, and a high complexity of labour organization.

First of all, there are a lot of different kind of products, such as cruise ships, ferries, yachts, military ships, offshore. Some of them use high technology, whereas others have a traditional low technology process. High-tech products rely on new materials, electronics, satellites, robots, AI, digital devices, whereas low-tech products use traditional construction process by steel, old mechanics, old plastics, wood.

This kind of heterogeneity of products and technologies determines the complexity of the supply chain, where the industrial supply chain consists of a huge number of manufacturing as well as service companies: the former deal with mechanics, electronics, communication, plastics, and engineering; the latter with repairing and maintenance service, shipyard service, refitting service, insurance, and finance service (Symbola, 2019).

Picture 1 shows that the shipbuilding industry has a composite labour organization and supply chain. At the top of the pyramidal production cycle there is the final assembler, specialized in the production of complete commercial ships, military ships, cruise, or yachts. The first tier of the chain supplies the final assembler with full modules and systems, whereas the suppliers of the subsequent tiers are usually small-sized firms, for small parts and components. This area is mainly composed of small artisans, that are located in the industrial districts (Tracogna, 2010).



Final assemblers:
Merchant ship manufacturers
Yacht manufacturers
Naval ship manufacturers

Supply chain:
-Industrial components and parts;
-Service: Ship repairers, Shipyards, Refitting service, Port service, Marine terminals, Docks, Insurance, Finance.

Picture 1. Shipbuilding supply chain. Source: CNR-IRCrES.

The input-output tables confirm that shipbuilding suppliers are present in almost all the economic sectors, as the commercial ships, the naval vessels and the yachts are complex objects from a technological and, above all, organizational point of view. The components that flow through the supply chain are numerous and refer to heterogeneous technologies: some of them come from mechanics, others from plastics, new materials, and electronics. Over the last decades, the latter has become very relevant for on-board services and navigation instruments. In general, specialized services for the shipbuilding industry are more and more important – such as refitting, maintenance, cruising, leisure, catering – and even the financial and insurance services become crucial for the firm competitive advantage (Bruni & Carcano, 2009). For example, the competitive advantage in the yacht industry is linked to the financial opportunities that leaders can offer to the clients.

In addition, the characteristic of the supply chain has a geographical concentration, too.

In order to exploit external economies, the final assembler is located close to the local supply chain, creating an industrial district specialized in a single family of products, such as yachts at Viareggio, cruises at Monfalcone, naval vessels at La Spezia. Other important districts are Genova, Livorno, Napoli, Ancona, Forlì, Trieste.

As the leading firms have a product specialization too, there is a strong link between products, industrial districts, and leaders: each industrial district has a product specialization and one or few leading companies, which are the final assemblers of their pyramidal supply chain. For example, the most important Italian firm, Fincantieri group, is the leading company of the Trieste-Monfalcone area; Azimut-Benetti, Sanlorenzo, The Italian Sea Group, Intermarine, and Overmarine are the leaders located in the Tuscan industrial district, in the area from Livorno to Viareggio, Carrara and La Spezia, too. Even if Ferretti group (Ferretti, Riva, Pershing, Itama, CRN, Custom Line e Wally) has several multibrand production sites, it is historically located in the Adriatic Sea district of Forlì-Ancona.

The medium-sized dimension of the Italian firms, apart from the Fincantieri case (4 billion euros of turnover), determines a low degree of diversification and a high degree of product specialization of each company: Italian Sea Group, Palumbo, Absolute, Overmarine produce yachts; Intermarine produces military ships; Cantiere Navale Visentini makes ferries (ro-ro and ro-pax); Rosetti group makes oil platforms; and so on. More recently, there are a few cases of

product diversification, looking for exploiting economies of scale in the financial resources, but this is not a widespread strategy of growth.

3. FIRM'S SIZE AND OTHER STRUCTURAL CHARACTERISTICS OF THE SECTOR

According to the CNR database on Italian firms, the shipbuilding[1] sector is made up of more than 1,800 companies and 30,000 employees (table 1).

Table 1. Number of firms and employees by firm's size

Firm's size	Number of firms	Employees	% Firms	% Employees
Large	7	11,441	0.4	37.6
Medium	73	6,651	4.0	21.9
Small	410	8,595	22.7	28.3
Micro	1,320	3,722	72.9	12.2
Total	1,810	30,409	100	100

Source: CNR-IRCrES.

Table 1 shows that the 1,810 companies in the shipbuilding sector can be broken down into 1,320 micro-enterprises, 410 small enterprises, 73 medium enterprises, and only 7 large enterprises[2].

The micro-sized firms represent 73% of the frequencies, followed by small-sized firms (23% of the total firms) and by medium-sized enterprises (4%). The importance of large companies emerges with their 11,400 employees, which determine more than 38% of the total employment. Another large share of employment refers to small (28%) and medium-sized (22%) firms, while micro-sized firms count for only 12% of total employees.

This distribution reflects the most important feature of the Italian manufacturing industry, with the widespread presence of small and medium-sized firms and the dominant role played by very few leading firms, as far as the employment is concerned[3].

[1] We process all the firms operating in the Ateco 30.1 code.
[2] We process four size classes:
- micro firms, less than 10 employees;
- small firms, between 10 and 50 employees;
- medium-sized firms, between 50 and 250 employees;
- large firms, more than 250 employees.
[3] Not only employment but production, too (see below).

Table 2. Average number of employees

Firm's size	Average number of employees
Large	1,634
Medium	91
Small	21
Micro	3
Total	17

Source: CNR-IRCrES.

The differences between the firm's size emerge in the average employment of each size class, with the 7 large firms having an average of 1,634 employees and the 1,320 micro-sized firms with only 3 employees each one (table 2). The sector average is about 17 employees per company and it summarises this great dimensional heterogeneity.

Table 3. Geographical distribution of firms and employment

Region	Employees	Number of firms
Friuli-Venezia Giulia	9,859	102
Toscana	3,122	288
Liguria	2,723	160
Emilia-Romagna	2,407	88
Campania	2,387	177
Marche	2,284	156
Lombardia	1,764	197
Piemonte	1,734	35
Sicilia	1,156	154
Veneto	1,057	111
Other regions	1,905	342
Total	30,409	1,810

Source: CNR-IRCrES.

Table 3 shows the geographical distribution of the shipbuilding companies, and it highlights the regions with the most important industrial districts, such as Friuli Venezia Giulia (Fincantieri headquarters), Toscana, and Liguria. As already mentioned, each industrial district has its own product specialization and its supply chain leaders, as analysed in section 6.

4. BALANCE SHEET ANALYSIS OF 876 LIMITED COMPANIES

4.1. Structural characteristics

Within the 1,810 companies in the sector, the CNR-IRCrES database has detailed financial information on 876 limited (ltd) companies that published their balance sheet in 2019.

Table 4 shows the considerable importance of the 6 largest ltd companies, which account for 68% of the sector's production, followed by 50 medium-sized firms with 16% of production[4]. The high presence of small and micro companies represents only 12% and 4% of production, respectively.

Table 4. Number of ltd firms and value of production

Firm's size	Number of ltd firms	Value of production (million euro)	% number of ltd firms	% value of production
Large	6	6,378	0.7	68.4
Medium	50	1,463	5.7	15.7
Small	273	1,116	3.2	12.0
Micro	547	0,365	62.4	3.9
Total	876	9,324	100	100

Source: CNR-IRCrES.

The distribution of the production value (table 5) finds another confirmation of the relevant role of the leading firms: while the 876 ltd companies produce on average about 10 million euros each one, the 6 large companies of capital have an average production of about one billion euros whereas medium-sized companies have 29 million euros.

Table 5. Average production

Firm's size	Average production (million euro)
Large	1,063
Medium	29
Small	4
Micro	0,7
Total	10

Source: CNR-IRCrES.

The distribution of the production value by location of the ltd company confirms the concentration of the sector in the regions where the industrial districts of the shipbuilding sector are present (table 6). Friuli-Venezia Giulia emerges with 46% of the entire production thanks to the presence of Fincantieri, followed by Liguria, Toscana and Emilia-Romagna, that count for about 14-10% of total production each one.

[4] We process four size classes according to the value of production:
- micro firms, less than 2 million euros;
- small firms, between 2 and 10 million euros;
- medium-sized firms, between 10 and 50 million euros;
- large firms, more than 50 million euros.

Table 6. Geographical distribution of production of ltd firms

Region	value of production (million euro)	% value of production
Friuli-Venezia Giulia	4,817	46.1
Liguria	1,509	14.4
Toscana	1,313	12.6
Emilia-Romagna	1,093	10.5
Lombardia	549	5.2
Marche	293	2.8
Veneto	284	2.7
Campania	194	1.9
Sicilia	124	1.2
Piemonte	44.	0.4
Other regions	236	2.3
Total	10,460	100

Source: CNR-IRCrES.

4.2. Financial structure

Table 7. Financial ratios

Firm's size	Coverage ratio (*equity + long-term debt / fixed assets)*	Financial dependence *(debts / total liabilities)*	Sustainability index *(financial debts / gross operating margins)*	Current ratio
Large	120	77%	2.0	110
Medium	168	74%	2.5	129
Small	117	74%	19.2	113
Micro	71	94%	22.6	114
Total	121	77%	2.8	112

Source: CNR-IRCrES.

A financial structure is solid if there is a balance between the sources and the uses of the financial resources. To verify this, some indices obtained from the preparation of the financial statements of the sector for 2019 are examined, such as the coverage index of financial assets, the financial dependence index, the sustainability index of financial debts, the current ratio (Manello & Calabrese, 2017).

Business literature states that a firm with solid assets has a coverage ratio of fixed assets (equity + long-term debts / fixed assets) ideally between 100 and 130. Values lower than 100 indicate that the company makes investments in fixed assets using, in an improper way, even short-term debts. On the contrary, values well above 130 show that the company has an excess of long-term financial resources compared to the necessary investments, resources that are in fact also used to cover short-term investments in addition to fixed assets.

In the shipbuilding industry, the coverage of fixed assets is optimal in its aggregate, and in all size classes, except the case of micro enterprises which are generally characterized by low levels of equity (table 7) (Manello & Calabrese, 2018).

The index of financial dependence, given by the ratio between debts and total liabilities, indicates whether the role of third-party capital in making corporate investments is preponderant and excessive, or whether it is complementary to the role played by the equity. In the first case, the dependence on the renewal of the debt and its burden could reduce the autonomy decision of the company. As far as the shipbuilding industry is concerned (table 7), the average financial dependency index is 77%, and is slightly higher than the threshold recommended by the literature (70%), indicating the quite robust weight of equity (23%) that support the corporate investments. However, we note the excessive degree of undercapitalization of micro enterprises, as they have an excessive dependence on borrowed capital (94%).

The sustainability index of financial debt (financial debt/gross operating margin) indicates how many years companies take to repay financial debt using the cash generated in the operations. The limit identified by the literature is 4 years. As can be seen in table 7, there is a clear difference between micro and small firms, on the one hand, and medium and large enterprises, on the other: the former have financial difficulties due to an excessive level of indebtedness.

A spread indicator in the literature to determine the financial liquidity of the company is the "quick ratio", calculated as the ratio between short-term assets, nets of inventories, and short-term liabilities. The comparison between current assets and short-term debts indicates whether the company is able to repay the short-term debts by the convert of the short-term assets. However, in the case of the shipbuilding sector it is more appropriate to apply the "current ratio", that is the ratio between short-term assets and short-term liabilities, which also contains data on inventories, as the production cycle of the shipbuilding is order-based, with a high degree of "work in progress" and therefore of inventories of semi-finished products. In the past, the company literature suggested that this indicator was optimal around 200, but the current trend and the specificity of the shipbuilding sector lead us to believe that the values included in the 100-130 threshold are also excellent. As can be seen in table 7, all the size classes exceed the limit of 100, which denotes full coverage between short-term credits and debts, with medium-sized enterprises reaching up to 129.

4.3. Productivity and profit ratios

Labour productivity, measured by the ratio between added value and labour cost, is linked to the size of the company, with large shipbuilding companies having a productivity almost double than that of micro enterprises: one euro of wages generates a value added of 2.33 euros on the average for the sector, with the large firms reaching 2.75 euros (table 8).

Part of the productivity differential existing between company sizes is attributable to the pyramidal organization of work, with large companies assembling components supplied by smaller companies, and the former have a strong value chain that generates a high value added.

The rotation of working capital, calculated from the ratio between turnover and working capital (inventories + short-term credits), reflects the efficiency of short-term investments. On average, for every euro invested in working capital, one euro of turnover is generated within the production cycle, with a particularly high index in small businesses that reaches 1.5 (table 8).

The profitability of investments, measured by ROI as the ratio between operating income and investments, decreases according to the company's size, with large companies where ROI is 4.2% and micro companies where ROI is zero (table 8).

The ROS indicates the net income obtained from each euro of turnover. We have the same comments mentioned before: large companies having an income of 6.2% and micro companies without any positive ROS (table 8).

Table 8. Productivity and profit ratios

Firm's size	Labour productivity	Rotation of working capital	ROI	ROS
Large	2.75	0.90	4.2%	6.2%
Medium	2.02	1.34	2.6%	3.1%
Small	1.70	1.56	2.8%	3.0%
Micro	1.52	1.16	-0.3%	-0.4%
Total	2.33	0.98	3.8%	5.3%

Source: CNR-IRCrES.

5. EXPORTS

In 2019, exports from the shipbuilding industry amounted to approximately 4.4 billion euros. The distribution of exports by area of destination indicates which are the most important foreign markets for shipbuilding companies. The role of "other OECD countries" (i.e. USA, Canada, and Australia) emerges, and it determines almost half of total exports, followed by European countries with almost a third of the total (table 10).

Table 9. Exports by area of destination

	Millions of Euros	%
Europe	1,352	30.6
Asia	352	8.0
Africa	22	0.5
North America	2,131	48.3
Central & South America	557	12.6
Total	4,415	100

Source: Own elaboration based on Istat data.

If we go into detail on the breakdown of exports by country of destination, the United States plays a primary role, with as much as 44% of total exports. The distance between the United States and the other countries that import from the Italian shipbuilding sector is considerable, as it can be seen in table 11, and it confirms the strong links between the Italian exports and the US economy, regarding mainly the cruise ships as well as the yachting.

The geographic concentration of exports is therefore considerable, not only regarding the first country that imports from Italy, but also if we consider the top-9 export destination countries, that account for 80% of the total exports.

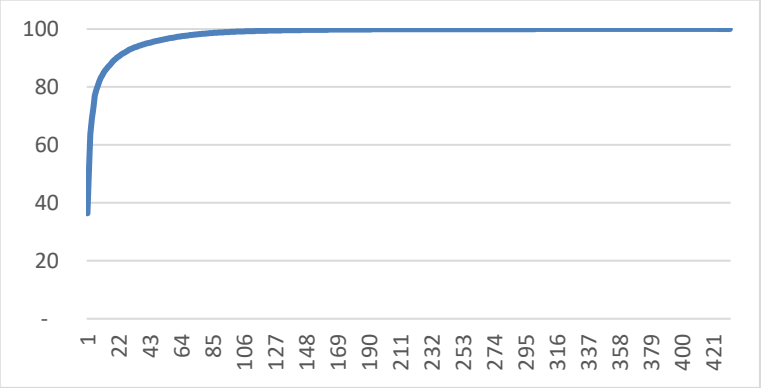
Table 10. Top-9 destination countries of exports (2019)

	Millions of euros	**%**
United States	1,964	44.5
Cayman Islands	278	6.3
Malta	249	5.6
France	238	5.4
Spain	230	5.2
Cyprus	220	5.0
Australia	153	3.5
UK	124	2.8
Hong Kong	100	2.3
Other countries	854	19.4
Total	4,415	100

Source: Own elaboration based on Istat data.

The export data can be further analysed at a microeconomic level to define the business concentration of the export flows and the number of exporting companies within each country.

In 2019, there were 430 exporting companies in all, more than a quarter of the total companies of the industry and almost half of the ltd companies. However, the distribution of exports within this high number of companies is very asymmetrical and concentrated. Indeed, more than three quarters of exports (77%) come from the international activity of only 6 companies, leaving the remaining 424 companies with only 23% of total exports in 2019 (graph 1).

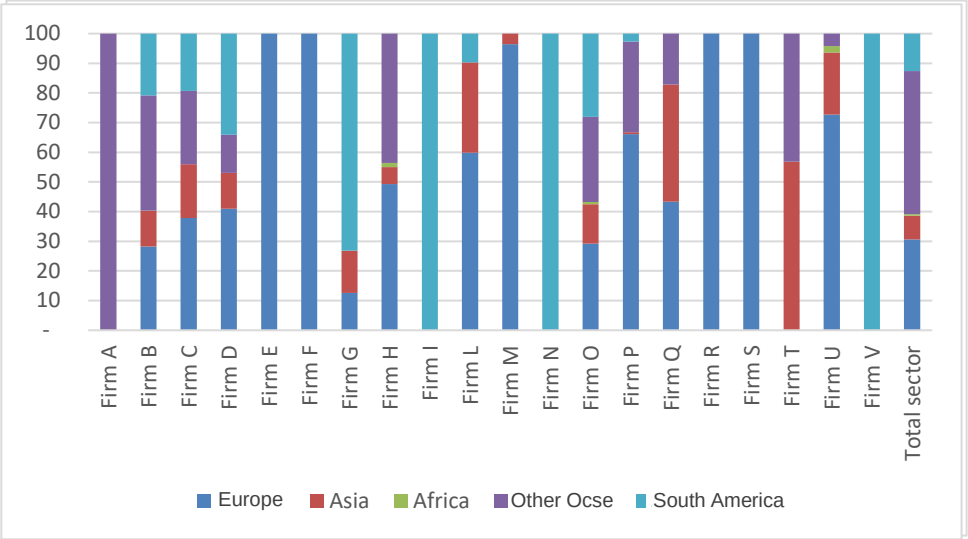


Graph 1. % export concentration of exporting firms (2019).
Source: Own elaboration based on Istat data.

These data confirm the role within the international growth played by big leaders of the shipbuilding sector, such as Fincantieri, Azimut-Benetti, Ferretti, Sanlorenzo, Cantiere Navale Visentini, Palumbo Superyacht, Absolute, CRN, Overmarine, Italian Sea Group, Viareggio Superyachts.

The distribution of export by area of destination at microeconomic level highlights the geographical specializations of each leader. Within the international growth strategy, there are some leaders who concentrate exports in a single area, on one side; and, on the other side, other leaders who have a wide presence around the world. Graph 2 shows the geographical

diversification of the top-20 companies: half companies are concentrated in one area, while the remaining half are diversified, but only two companies are present in all the five geographic areas examined here.



Graph 2. Export diversification of top-20 exporters.
Source: Own elaboration based on Istat data.

6. INDUSTRIAL DISTRICTS OF THE SHIPBUILDING SECTOR

The location of the leaders has a direct reference in the main Italian industrial districts of the shipbuilding sector, confirming the role played by the territory and by the local supply chain. The latter is one of the most important determinants of the Italian leaders' competitive advantage.

Table 11. Leaders and their industrial district

	Industrial district
FINCANTIERI	Trieste
AZIMUT-BENETTI	Viareggio-Livorno
FERRETTI	Rimini-Pesaro
SANLORENZO	La Spezia
THE ITALIAN SEA GROUP	Massa-Carrara
CANTIERE NAVALE VISENTINI	Venezia
C.R.N.	Rimini
OVERMARINE GROUP	Viareggio
CANTIERE NAVALE VITTORIA	Rovigo
PALUMBO SUPERYACHTS	Ancona
AMICO & CO.	Genova
CANTIERE DEL PARDO	Forlì-Cesena
CANTIERE DELLE MARCHE	Ancona
SOLARIS YACHTS	Udine

Source: Own elaboration based on Istat data.

The importance of the leaders within their industrial district can be valued by the distribution of shipbuilding employment. Table 12 shows the areas with more than one thousand employees, where the emerging role of Trieste is indisputable, as it counts for more than 8,000 workers[5].

Table 12. Top-10 industrial districts by employment

Area	Employees
Trieste	8,180
Napoli	2,074
Torino	1,703
Lucca-Viareggio	1,703
La Spezia	1,510
Forlì-Cesena	1,348
Gorizia	1,266
Pesaro e Urbino	1,165
Genova	1,062
Ancona	1,005
Italia	30,409

Source: Own elaboration based on Istat data.

Table 13 shows the exporting areas with more than 100-million-euro exports and therefore indicates the most active industrial districts at the international level. It could be the effect of their competitive advantage.

Table 13. Top-10 industrial districts by exports

Provincia	**Millions of euros**
Trieste	952
Lucca	692
Gorizia	686
Rimini	282
Ancona	224
Forlì	204
Pesaro	193
Torino	182
Padova	179
La Spezia	149

Source: Own elaboration based on Istat data.

[5] The high level of Torino derives from the fiscal location of the Azimut-Benetti holding, even if its main shipyards are in Viareggio and Livorno.

The Friuli-Venezia Giulia district, with the provinces of Trieste and Gorizia, is the most important one, thanks to the presence of Fincantieri, the leader which determines a significant share of the total exports.

The second district in term of exports is Viareggio, the most important area for the pleasure boating, with a very high level of internationalization (Lazzaretti & Capone, 2009).

The Adriatic area has a significant role within the international growth, as there are notable exports coming from the firms of Rimini, Forlì, Pesaro and Ancona.

The list of top-exporting areas ends with the shipbuilding industry of La Spezia.

The comparison between table 12 and table 13 shows a sort of export productivity at district level, i.e. euros of exports per workers (table 14). Lucca and Gorizia have the best ratios, mainly due to their high value-added products, whereas the others (La Spezia, Forlì, Pesaro and Ancona) have a lower data, even if it is higher than the average of the Italian manufacturing industry. On the contrary, Napoli and Genova are not present in the list of table 14 because they are more important for their employment than for their exports. Maybe, the difference is mainly due to their labour organization, as they could be mostly manufacturing suppliers of the export leaders, or because of their propensity to serve the internal market and not the international one.

Table 14. Export productivity

Area	Exports per employee (euros)
Trieste	116,436
Lucca	406,632
Gorizia	542,630
Ancona	223,443
Forlì	151,784
Pesaro	166,540
Torino	107,136
La Spezia	99,317

7. SOME CONCLUDING REMARKS

Within the shipbuilding sector there is a complex hierarchical organization structure, where few leaders have a large supply-chain composed of hundreds of micro and small companies. The supply chain is mainly organised at the local level, and it forms the local industrial district. The main characteristic of the supply-chain is its pyramidal organization, with a leader at the top, medium-sized companies at the first tier, and very small firms and artisans at the second tier.

The industrial districts are composed of manufacturing and service firms: the former deal with mechanics, electronics, communication, plastics, and engineering; the latter with repairing and maintenance service, shipyard service, refitting service, insurance, and finance service.

The industry is composed of more than 1,800 companies and 30,000 employees, but only 876 limited (ltd) companies. In general, balance sheet ratios of the ltd companies show a robust financial structure, as well as good production dynamics, mainly thanks to a robust export intensity. Indeed, the pyramidal organization of the industry affects the results of the balance sheet analysis, because all the ratios and indexes about the economic and financial structure are very good for large and medium-size companies, and even for the small ones, but not for the micro firms. The latter have a bad problem of lack of equity that negatively affects all the financial structure, and indirectly the economic performance, too. We have to consider that, except for

Fincantieri, most of the other leading companies are usually family-owned companies, with traditional financial limits[6].

Another interesting characteristic of the shipbuilding industry is its high degree of internationalization, as in 2019 the exports are about 4,4 billion euros. There is a high concentration in exports, both at geographical and at firm level. Europe and North America count for 80% of total exports, and the top-6 leading exporters count for more than three quarters of total exports.

Maybe, the high concentration degree concerning exports derives from the pyramidal organization of the production, and the top leaders are the final exporters, whereas the first and second tiers of the supply chain are only indirect exporters.

In any case, our results suggest good opportunities for the Italian shipbuilding companies to recover from the 2020 economic crisis caused by the pandemic and to exploit all the opportunities of the 2021 good economic cycle.

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[6] One exception is Ferretti Group, owned by the Chinese Weichai Group, whereas the others are controlled by Italian families, such as Colaninno (Intermarine), Vitelli (Azimut-Benetti), Perotti (Sanlorenzo), Costantino (The Italian Sea Group), Balducci (Overmarine).