

# Trends in the structures development of the regional machine-building complex

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**Abstract.** In the process of market reforms of the Russian machine-building complex several distinct periods can be revealed. In this article the authors define periods of mass disintegration and spontaneous integration (since the beginning of the reforms until the financial crisis of 1996), post-crisis stabilization, directional specialization (2000-2008) and evolutionary development (since 2010). The economic consequences of the enterprises mergers and divisions are shown on the example of machine-building enterprises of the Middle Urals. The aim of this study is to substantiate the methodical approach to the selection of the optimal organizational structure for the machine-building business. The necessity of taking into account the extent of the personnel diversification and the production volume has been revealed for the optimum organizational structure determination in the machine-building associations. The authors have analyzed sales profitability of the 2745 machine-building enterprises, depending on the production scale and industry sector. The factors affecting the development of cooperative ties and outsourcing have been defined. The authors have made a conclusion that it is necessary to form technological chains as a new kind of business associations.

## 1 Introduction

The number of registered machine-building enterprises has increased dramatically during the privatization reform: from 6 to 60 thousand. At the same time there was a significant decline in machinery production, reduction of return on assets, increase in number of unused equipment and fixed assets deterioration. Even the global crisis of 1996 or 2009 did not lead to such significant disturbances in the work of machine-building enterprises, as the beginning of the spontaneous disintegration in the industry.

The retrospective analysis of changes in machine-building business structures has revealed some factors that affect the performance of the machine-building enterprises. Taking into account the factors identified in the organizational structure design of the machine-building associations allowed to develop a methodical approach to the creation of new innovative structure of machine-building complex. The relevance of this approach is related to the necessity of development of Russian machine-building industry as a key modernization sector of the economy, especially in the context of economic sanctions.

## 2 The economic consequences of institutional changes

The reform of the Russian economy has several clearly identified periods. The first phase is characterized by the division of the machine-building associations into independent enterprises and selling

formerly state-owned assets to private owners. This phase can be called the stage of mass disintegration. The well-known machine-building association "Uralmash" is the significant example of this process. More than 30 independent companies of different sizes have been created on the basis of this association. According to Russian researchers [1], the number of enterprises during this period increased by 10 times and reached 58.4 thousand in 1997.

At first the integration processes of newly established enterprises occurred spontaneously. Certain orderliness in the creation of associations can be seen after the first Russian financial crisis of 1996-1998. The reform stages and their implications are listed in Table I.

Classification of the newly established associations according to the purpose and way of creating includes 4 main types.

1. *"Buy everything"*. This is particularly true for the period of property redistribution from mid to late 90s.

The associations were formed by the owner from the number of absolutely technologically unrelated companies. The main formation strategy of such associations was conglomerate diversification

2. *Segregations from the mono-enterprise*. The subsidiaries are segregated from the parent company in order to reduce costs and risks.

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**Table 1.** Reform stages and their implications.

Stage and its characterization	Trends	Number of enterprises	Organizational forms	Indices of change in production of machinery and equipment by the end of the period
Until 1992	Planned economy	Up to 6 thousand	State-owned enterprises	100%
1992-1994. - The first property redistribution. Corporatization and privatization of state-owned enterprises	The emergence of private ownership in the industry, the division of assets	Up to 60 thousand	The emergence of multi-disciplinary regional associations established on the "buy everything" principle, the transfer of non-core divisions into independent companies	31%
1994-1998. - The second property redistribution. The struggle for the controlling stake	Monetary privatization. Bulk purchase of shares from outsiders	Up to 60 thousand	The emergence of private Russian machine-building corporations, the acquisition of Russian companies by foreign owners	84%
1998-2005. - The first Russian financial crisis		Up to 30 thousand	Mass bankruptcy of enterprises	140%
2001-2008. - The third property redistribution	Corporatization of state-owned enterprises	Up to 30 thousand	The emergence of Russian state corporations, mainly in the field of defense industry	125%
Since 2008 - the crisis and post-crisis development	Strengthening of the state support and regulation. Leasing schemes of hardware upgrades	Up to 50 thousand	Bankruptcy of medium sized enterprises, transfer of non-core assets into subsidiaries	84%
Since 2013 – political restraints	Strengthening of the state support for the defense enterprises	Up to 50 thousand	Stabilization of the business structure	96%

3. *Technological unity.* The companies in the association are connected by a single production cycle. The association is developing according to the related diversification strategy, forming the integral complex of enterprises. The owners create a union on the principle of the technological chain unity. [2]

4. *Belonging to the state ownership.* The associations are created to ensure the efficiency of the state-owned enterprises, mainly producing weapons and military equipment.

Currently, more than 1/3 of the machine-building enterprises are part of large associations. Independent companies have sales volume of about one billion rubles.

This study is limited to the analysis of the legal structures activities. Legally registered associations assume a managing company existence, a structure, which will coordinate the work of all enterprises in this association (technology exchange, joint development of new products, co-operation between enterprises), and allocate resources between companies. For such structures there is a need for the clear management system.

Although the authors believe that the term 'business association' can be used both for legally registered structures and unregistered structures. For

example, a structure with strong technological and financial constraints can be seen as a business association. As an example of such association we can take a conglomerate consisting of a parent company and subsidiaries segregated from it. This view is consistent with the model of the enterprise, introduced by G. Kleiner [3], since such structures have five necessary sets: property, labor, institutional, informational and business model complexes.

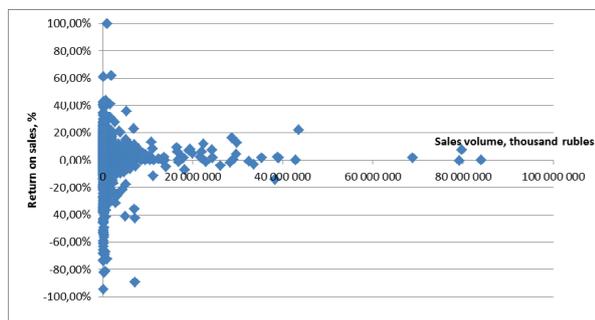
The limitations of the research object only to legally registered structures allows solving questions of the resources concentration scale and the allocation of resources within the structure.

### 3 The effectiveness of the resources concentration in the machine-building association

The sample of 2745 Russian machine-building enterprises from various industrial branches was taken to analyze the concentration effects. We have discovered the reduction of sales profitability in all enterprises having large sales volume (see Fig. 1).

The revealed tendency is typical both for industries with minimum return on sales volatility and for the sectors with the maximum gap between the performance of separate enterprises. Undoubtedly, the profitability of

sales is influenced by a variety of other factors, which explains the "spread" of indicator for individual enterprises (Table 2). It is necessary to mention that return on sales was calculated as the ratio of net profit (from all activities of the enterprise) to sales revenue (only from the main activity).



**Fig. 1.** The distribution of legally registered companies and associations in terms of sales volume and sales profitability in 2013 (calculated by authors according to the electronic resources base FIRA.).

As some enterprises demonstrated income and profit from other types of activities much greater than from their main activity it came out that return on sales was evaluated as 100% and even more (which is impossible for main activity calculations solely).

Because of this approach to calculation the return on sales for some enterprises has reached such catastrophic values as -221.33% and even -977.6% (which means that this company actually sold out their property).

However, the overall trend of the indicator is as follows: increase in the scale of production leads to decrease in sales profitability. Economic-organizing meaning of this trend is that the managing costs of large organizations rise significantly. At the same time optimally structured associations have the opportunity to spread risk by diversifying activities.

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**Table 2.** Volatility of return on sales according to the machine-building sector.

NCEA code	NCEA code formulation. Production of:	Number of enterprises	Return on sales, %		
			Min.	Weighted average	Maximum
29.1	mechanical equipment	375	-221.3	6.11	100.0
33	medical equipment, measuring devices and optical instruments, watches	237	-18.98	5.27	39.76
29.22	materials handling equipment	205	-68.07	4.85	214.2
31.2	electricity distribution and control equipment	295	-111.9	4.63	62.01
29.23	industrial cooling and ventilation equipment	203	-38.31	3.38	42.65
31.1	electric motors, generators and transformers	150	-36.83	3.13	30.14
35	ships, aircraft and spacecraft and other vehicles	186	-124	1.54	35.10
34	motor vehicles, trailers and semi-trailers	489	-123.6	0.65	61.15
29.5	machinery and equipment for special purposes	418	-68.5	-0.14	43.91
29.3	machinery and equipment for agriculture and forestry	97	-127.7	-0.71	24.27
29.4	machines	87	-977.6	-8.40	16.54

As an example, we give the return on sales dynamics of one machine-building holding – “Sinara - Transport

Machines”. The specialization of this holding is transport machinery (Figure 2).

The analysis of other machine-building holdings showed that the most successful associations have the centered type of diversification, deliver a full range of services and incorporate research organizations.

#### 4 The methodical approach to the organizational structure formation of a diversified machine-building association

In order to measure the degree of optimal diversification we propose to use the matrix of the product diversification and the degree of administrative resource diversification, since human resources (personnel) is the most difficult, inert, expensive at any change component of the enterprise resource potential. To assess the level of diversification we use Herfindal-Hirshman index proposed by Berry C.H. [4], which was originally designed to measure the degree of industries concentration.

Depending on the ratio of production and personnel diversification degree we propose to form the "diversification matrix" classification (Figure 3), which shows the rankings of diversified businesses. The threshold values of the index are selected according to empirical studies, such classification is used by Strategic Management Journal in its practice [5].

The index values greater than 0.7 points show that the union is highly diversified.

To optimize the structure of such association a range of measures is provided. First of all, we propose to analyze the possibility of outsourcing for products and services with a small share in the production volume. The second measure is the expansion of autonomy in strategic decision-making by individual enterprises. The third measure is strengthening the innovative potential of the association to form a technological chain.

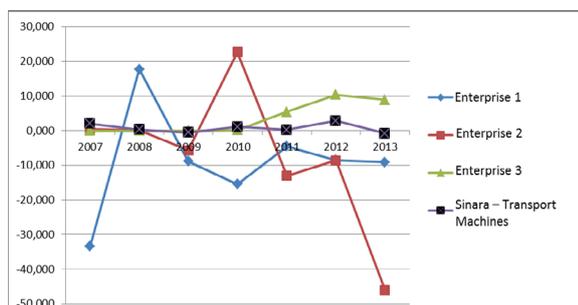


Fig. 2. Return on sales dynamics of individual machine-building enterprises and the holding as a whole, %.

The concept of the "technological chain" is interconnected with the concept of "customer value chain" and allows defining the strategic prospects of the existence of this or that production in terms of meeting the consumers needs. The structure of the technological chain should include the "core" of the chain – an innovative company; manufacturing enterprises, providing the main functions; and buffer zone enterprises, performing secondary functions. The concept of the technological chain is more in line with

the contractual business association, rather than their joining in the legally registered form. However, in Russia, the processes of outsourcing and co-operation are underdeveloped, which forces businesses to keep "buffer zone" enterprises within the association.

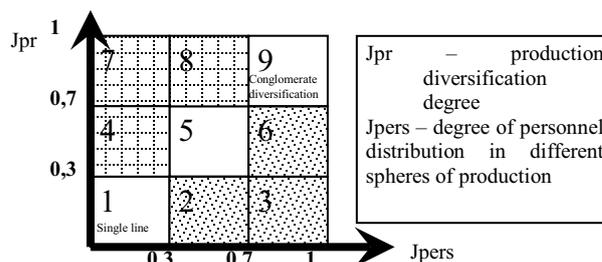


Fig. 3. Conformity assessment matrix of conformity of the association organizational structure to the product diversification.

According to the survey the managers of the machine-building enterprises named the unpreparedness of the legal framework, the terms and supply quality violation by contractors as reasons for the slow spread of the production processes outsourcing in Russia.

#### 5 Conclusion

The phase of spontaneous integration of the machine-building enterprises has been replaced by the ordered diversification phase.

The structure of the regional machine-building complex now on 2/3 consists of independent companies with the sales volume slightly exceeding 1 billion rubles and 1/3 of large enterprises being a part of the private and public associations.

The associations of the machine-building enterprises implement the centered diversification strategy, getting rid of non-core assets, but the implementation of this strategy is complicated because of the legal framework and industrial outsourcing practice absence.

The further development of the enterprises is possible towards the creation of non formalized associations in the form of the technological chain, with the innovative enterprises as the core.

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