“Hi-tech entrepreneurial structure upgrade project”

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Abstract

An innovative development of the Russian economy is impossible without a competitive high-tech entrepreneurship sector. This paper discusses the criteria of referencing an entrepreneurial company to the high-tech sector. The competitive ability of entrepreneurial companies, which use high technologies in their business, depends on a plenty of internal and external factors. The internal factors are of special importance since they are controlled by and dependent on the entrepreneurial company management activities. An up-to-the-date know-how base is one of internal sources for providing high competiveness of high-tech entrepreneurial companies. This article substantiates the dependence of the enterprise's competitive ability vs its technological level. This study also reveals alternative approaches to upgrading a know-how base of high-tech entrepreneurial companies, and analyzes the opportunities of using alternative approaches identified. Furthermore, an action item list for the know-how base upgrade is suggested in conclusion. This article substantiates the correlation between the competitiveness of enterprises and their know-how level. The emphasis is made on the comparison of available alternative options for upgrading a know-how base of hi-tech entrepreneurial structures.

Keywords: hi-tech enterprise, machine-building industry, upgrade, innovation, competitiveness.
JEL Classification: O32.

Introduction

A number of tasks have been set in the Concept of Long-Term Social and Economic Development of the Russian Federation up to 2020. For example, it's planned to capture a notable share (5-10%) of hi-tech commodity markets, increase a hi-tech sector share in GDP up to 17-18%, ensure a 5-6-fold growth in the share of innovative products in the total volume of products shipped, and enlarge the share of innovation-intense enterprises up to 40-50% [9].

The implementation of the above mentioned tasks depends, first of all, on the status of innovative activities and on the development of hi-tech sectors of the economy, which are no like other forge a basis of innovative economies and "determines public wellbeing" [10].

In accordance with the methodology of the Organization for Economic Cooperation and Development (OECD) [1], the following businesses are referenced as hi-tech sectors of the economy: hi-tech activities – production of pharmaceuticals, aviation & space equipment, medical devices, precision & optical tools, radio, TV & communication equipment, office equipment and computer hardware; middle-level hi-tech activities − machine-building industry and production of chemicals, excluding pharmaceuticals. However, some researchers note that the "high technology" attributes may be different [7], e.g., the ratio of R&D expenditures to corresponding product output volume exceeds the world's average level in the processing industry of the developed countries 1.2-1.5-fold [6] or a high value added share [15], or the leadership in technology provided through the development and promotion of dominant innovations to the national and global markets, as well as through the use of advanced technologies related to the up-to-date technology tenors [2]. Applying the above mentioned criteria, we find that the production of information technologies, production of pharmaceuticals and the machine-building industry are classified as hi-tech sectors, whereas the latter makes the highest multiplier effect on other industries. That's why achieving the specified tasks without a competitive machine-building industry will be rather problematic.

The level of development and the efficient use of productive forces is one of indicators of the machine-building industry's competitive ability (Borisov, Pochukayeva, Saakyan et al.). The issue of the know-how backwardness and its impact on enterprise's competitive ability was studied at different times by Borisov and Pochukayeva (2001, 2011), Gladyshevsky (2004), Mishchenko (2011), Rygalin (2006), and others.

There are several ways to resolve the know-how backwardness issue. The selection of the most appropriate one is dependent not only on the necessity of changing the age pattern, but also on the demand for know-how base enhancement (Ostapenko, Pochukayeva, Tatarskikh et al.).

This study (1) substantiates the dependence of a competitive ability of entrepreneurial companies, which apply high technologies, on their know-how level, (2) identifies and describes alternative options for upgrading the know-how base of hi-tech entrepreneurial companies. In conclusion, an action item list for the know-how base upgrade is suggested and a list of significant factors to make the know-how base effective is provided.

1. Machine-building enterprise upgrade alternatives

Different components of hi-tech business potential as a growth factor were studied by Balatsky, Borisov, Glisin, Golichenko, Grigoryev, Ostapenko, Pochukayeva, Revutsky, Saakyan, Salnikov, Samodurov, Fedoseyeva, Frolov, Khustalyov, etc., on the example of the machine-building industry.

The study of the machine-building enterprises' competitiveness showed that the competitiveness of hi-tech enterprises depends, first, on the enterprise management system competitiveness and, second, on the scientific and know-how competitiveness (Table 1). The last-mentioned factor is nothing else than the level and potential of innovative activities and the status of the know-how base based on which these innovative activities are carried out.

Table 1. Mean partial elasticity coefficients

Competitiveness coefficients	Sci-tech	Productive	Staff	Economic	Financial	Social	Management system	Products	Marketing
Coefficient value	0.113	0.114	0.104	0.049	0.064	0.024	0.248	0.157	0.11

And here comes the question also raised by Mishchenko [11] in his work: "Why the innovative development factor has not become the fundamental one for providing the competitiveness of domestic enterprises?" The answer to this question is not that simple, but Balatsky [3] thinks that "Until finance flows to equipment are insufficient, "money injection" in innovations will not work out". The following figures in this context look rather representative: the share of promising technologies in the machine-building industry is only 16-17%, whereas the share of worn-out and obsolete technologies is 35-38% [4]. Here comes another question: "Why the fixed asset backwardness hinders the perception of innovations?", and the following figures give the answer to this question: labor productivity in Russia depends on specific investments in fixed assets by more than 72%, on investments in innovations only by 18%, and on other factors by 10% [17]. Thus, we have to agree with Mishchnko who says that enterprises with an obsolete technical base are organically incapable of being competitive [11].

That's why we assert that the know-how base upgrade is a prerequisite for improving the competitiveness of the productive sector of the economy, in particular, a hi-tech part thereof.

In our viewpoint, major actions to be taken to improve a qualitative status of the know-how base may be shown in a diagram (Figure 1).

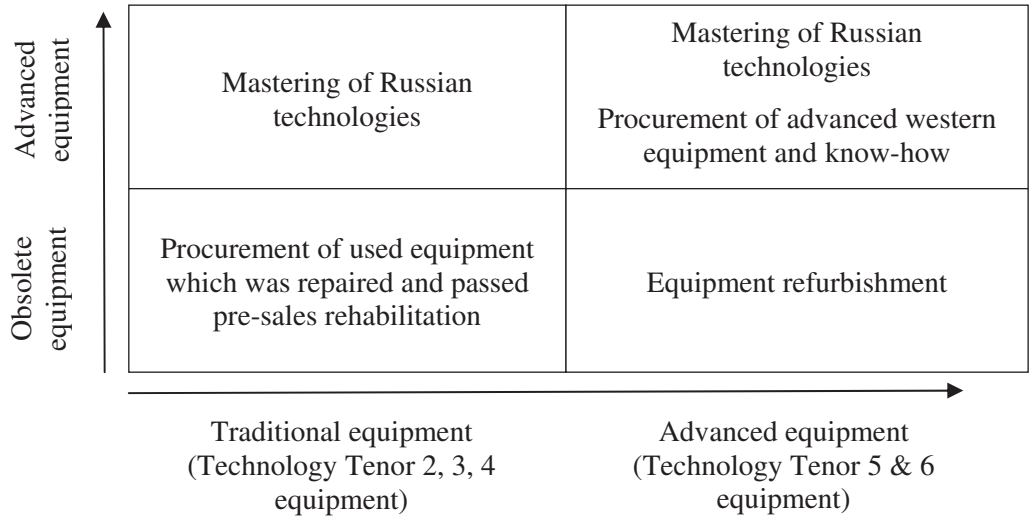

Fig. 1. Hi-tech enterprise know-how base upgrade options

Realizing that the above-shown division is arbitrary, nevertheless, let's consider each option in more detail in order to obtain the biggest return from a certain alternative.

1. Procurement of used equipment following its pre-sales rehabilitation at machine-building plants specialized in the repair of used equipment. However, it's necessary to take into consideration that this approach is not acceptable for resolving production issues on a serious basis, since different risks are rather high in this case. And the main risk is that the equipment purchased is worn-out and obsolete.
2. Development and mastering of Russian technologies. Several ways may be identified here: first, scale technologies used at small-sized innovative companies which master technologies at the pilot production level and tested the market with their products, and, what is most important, the market has absorbed these products; second, build-up the capacity of existing design offices which are

capable to develop principally new products, including breakthrough innovations; third, develop or establish new in-house design offices, which are capable to rather perfectly resolve issues associated with a current equipment refurbishment or product range renewal, but face difficulties in developing principally new products, let alone the penetration to new markets; fourth, develop Russian technologies in the framework of the import replacement policy implementation.

The following circumstances underpin the development of the last-mentioned alternative.

- First, the global companies' refusal to tackle individual specific issues of enterprises.
- Second, a ban to supply unique double-purpose equipment to Russia.
- Third, a myth of super-reliability of cheap import equipment and service arrangement by leading companies has been dispelled globally.

3. Procurement of advanced Western equipment and technologies. Studying this alternative, it's necessary to take into account that the procurement of advanced import equipment is much more expensive for Russian companies, rather than for a European company, due to the following factors: (a) Western companies receive loan facilities for fixed assets enlargement or renewal at more favorable conditions, than Russian companies do, and this factor makes an obstacle to long-term investing of domestic companies; (b) unlike Western companies, Russian companies, while considering the purchase of equipment, should instantly increase the cost of equipment by the amount of higher transport costs, taxes and fees; (c) Russian companies will pay more, than a Western company, to Western specialists for participation in installation and commissioning, since Russia is considered as a country with difficult living conditions; (d) costs required for maintenance of production premises and indoor infrastructure will be higher for a Russian company, than for a Western one, due to climatic features and an insufficiently developed infrastructure.

While installing typical Western equipment and mastering typical Western technologies, Russian companies start competing with foreign manufacturers in terms of price and quality, rather than consumer properties. But in this case it's necessary to take into account that this approach will allow us only to follow or keep in pace with our competitors, but not to be ahead of them.

In this case, fabrication of products, whose complexity and quality is superior to Chinese products and whose price is cheaper than in Europe, may become an additional global market niche (in addition to the sector of energy resources and derivative products) for Russian enterprises. This strategic niche is rather promising, but Russian manufacturers will face difficulties penetrating this niche. On one side, China keeps on mastering advanced and emerging technologies. On the other side, it's rather difficult to compete with European and American companies by price, in particular with those companies in which consumption of energy resources do not dominate in their cost structure. A gap in labor productivity and production efficiency also makes its contribution.

4. Upgrade of equipment, which may be considered as an option for enhancing machine tool unit reliability and capacity. Refurbishment brings in new consumer properties to equipment, and the use of advanced control systems, drives and motors allows parts to be machined within a shorter time and at a higher accuracy. On a way to a full-scale development of this market, it's possible to: (a) develop model upgrade projects for the most numbered and promising, in terms of refurbishment, equipment; (b) extend the offer of accessories for machining equipment refurbishment; (c) increase employee qualification to implement diversified large-scale projects and perform installation activities within a shorter timeframe; (d) resolve upgrade-related logistic issues associated with bulky equipment transportation and/or personnel trips to the site to participate in commissioning.

There are several ways to upgrade machine-tool equipment, i.e.:

- Upgrade brand new domestic machine-tool equipment. This is the most effective way of plant development and re-equipment, which makes it possible to shorten production cycle duration, decrease the number of primary and maintenance personnel involved, cut electricity costs and shorten equipment payback period as well as to improve production efficiency and provide adequate stability of qualitative indicators.
- Upgrade used domestic and foreign equipment through overhaul. Recovery of a geometric accuracy of key assemblies, in combination with a minor repair and implementation of advanced technologies in the equipment control systems, allows reaching and even exceeding a performance level of brand new machines.

While studying submitted alternative know-how base upgrade options, special attention should be paid not only to the necessity of changing the age structure thereof, but also to the know-how base enhancement needs. Statistic data, reflecting actual operation of a rather great number of enterprises,

reveals another area of concern, i.e. underloading of the equipment purchased. On average, the loading factor for new-purchased equipment falls within 21-49%. This equipment utilization level depends, first, on the approach to upgrading the know-how base, defined by the target orientation of the agent. Key approaches may be considered as follows [11]:

- Optimum approach (with a "price-to-capacity ratio" as the key equipment selection criterion).
- Imitative approach (selection is based on the criterion "not worse than our competitor or neighbor has").
- Simplified approach ("simple in operation" is the key equipment selection criterion).
- Urgent approach (preference is given to equipment with a minimum delivery period).
- Conservative approach (preference is given to the equipment known by previous operating experience, with the "experience" being the key equipment selection criterion).
- Cheap approach (with the "price" being the key equipment selection criterion).
- Functional approach (preference is given to up-to-the-date equipment which opens wide functional capabilities).

The last-mentioned approach may be used to resolve the task of a technical refurbishment with the aim to ensure the competitiveness of hi-tech enterprises. Regretfully, only a small share of enterprises follows this approach in practice.

Conclusion

The following action item list to find an integrated solution to this sophisticated and ambiguous problem is suggested:

1. Assess the status of an active part of fixed assets of plants in a given region, and develop proposals on the procurement of certain technologies. To develop regional hi-tech enterprise upgrade projects, it's necessary to engage specialists from leading machine-building enterprises and design offices to evaluate timeliness of design features of the equipment proposed for procurement.
2. Perform a predictive (tentative) estimate of a re-equipment project implementation costs. A minimum program, which, nevertheless, is sufficient enough by its critical mass and which allows the upgraded enterprises to achieve adequate competitiveness in terms of quality and novelty of products and labor productivity at enterprises, should be assumed as a benchmark program.
3. Invest in the approved key enterprise upgrade programs in a certain region, with a due consideration of inter-regional cooperation opportunities.

The implementation of the suggested program will become binding provided that: first, re-equipment of enterprises, in particular, hi-tech companies, will be supported by adequate legal framework; second, the use of such a state regulation tool as the Government Order, wherein the existing know-how base will be come a key factor saying in favor of the enterprise, is made more stringent; third, the return to a target use of amortization deductions, which, in fact, are one of the most effective sources for upgrading the know-how base.

Therefore, the implementation of the action item list will enhance the competitiveness of hi-tech entrepreneurial structures.

References

1. Aggregations of manufacturing based on NACE Rev 1.1 // Electronic resource. URL: http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/htec_esms_an2.pdf.
2. Babushkin V.P. (2013). Development of Innovative Potential of Vehicle Building Plants. – Synopsis of thesis, application to Ph.D. (economics), FGBOU VPO Ural State Mining University, p. 25.
3. Balatsky E.V., Raptovsky A.V. (2007). Innovative Process Matrix of Russian Regions, *Society and Economics*, 1, pp. 138-159.
4. Borisov V.N., Pochukayeva O.V. (2011). Processing Industry Upgrade Based on a Sustainable Development of the Domestic Machine-Building Industry, *Forecasting Problems*, 2, pp. 55-63.
5. Borisov V.N. (2011). Machine-Building: Restructuring and Competitive Ability, *Economist*, 7, pp. 214-245.
6. Frolov I.E. (2004). Potential for Development of Science Intensive, Hi-tech Sector of the Russian Industry, *Forecasting Problems*, 1, pp. 79-100.
7. Frolov I.E. (2005). Study and Prediction of Science Intensive, Hi-tech Sector of the RF Industry. – Synopsis of thesis, application to Doctor of Science (economics), M.: INP RAN, p. 43.
8. Gladyshevsky A.I. (2004). Prediction of Reproduction Processes in Economy (investment aspect). – M.: MAX Press, 381 p.
9. Innovative Russia – 2020. Section I, p. 8. // Electronic resource. URL: http://www.economy.gov.ru/minec/activity/sections/innovations/doc20101231_016.
10. Karacharovsky V.V. (2012). Effect of Innovative Activities in the Russian Economy at Macro/Meso Level, *Problem Analysis and State Management Engineering*, No. 6 (26), Vol 5, pp. 18-34.
11. Mischenko L.Y. (2011). Innovative Component of Up-to-Date Enterprise Competitiveness // BURGTU (NPI) bulletin, 3, pp. 25-31.

12. Ostapenko S.N., Fedoseyeva N.Y. (2010). Methodological Guidelines on Upgrade and Re-equipment for Small / Medium Sized Production Enterprises. – M.: Interregional Center for Industrial Subcontracting and Partnership, Ltd, 80 p.
13. Pochukayeva O.V. (2011). Machine-Building Industry Development Prediction Model. In the book: Scientific Works Compendium: RAS National Economy Forecast Institute // Edited by A.G. Korovkin. – M:. MAX-Press, pp. 259-277.
14. Rygalin D.B. Cluster Approach Implementation Issues // InVestRegion, 2006, 3, pp. 58-63.
15. Saakyan Y. Z., Grigoryev A.V. (2010). Map of Industries: Way to Economic Growth // Rail Machinery, 3 (11), pp. 25-32.
16. Tatarskikh B.Y. (2011). Economic and Organizational Factors of the Russian Machine-Building Industry Upgrade Process, Economic Sciences, 4, pp. 147-153.
17. Vaganov A. Innovative Matrix, Nezavisimaya Gazeta // Science, January 24, 2007, p. 13.