

# Local Innovations and Global Technology Leadership: Rethinking Approaches to the Effective Intra-Industry Technology Transfer

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**Abstract**— The relevance of the study is characterized by the acceleration of the growth rate of innovations, technological singularity and increased environmental uncertainty along with technological backwardness and low innovative activity of Russian companies, which attaches particular importance to the development of a methodology for imitation innovative strategies of companies. The article explores the features of global technology leadership strategies and local innovation. A research conducted to access the DEA-effectiveness of Russian IT-companies' performance has been used as an example of evaluation of company's imitation potential.

**Keywords**— *network structure of the economy, global technology leadership, innovation activity, imitation strategy*

## I. INTRODUCTION

The processes of accelerated digitalization of all spheres of human activity are accompanied by enhanced interaction of participants of the economic relations in real time. It is manifested in a change of the nature of the economic space organization and a move to a network structure of the economy. According to N.N. Dumnaya there are the following types of interaction in a network economy: resonant oscillation, when the replication of the successful types of structures occurs (network type of an organization), co-evolution, convergence of dissimilar companies which are at the different stage of the development having different evolution rate. The results of these interactions are enterprises of the new type such as a network, horizontal, virtual, fractal, self-learning, intellectual etc. [1].

A distinctive feature of the activity of the network forms of interaction in the sphere of R&D is determined by the logics of innovation process and the necessity of the reciprocal exchange of competencies, which is capable of generating of

the new ideas and combining new technologies. As a result, independent and joint researches become complementary processes ensuring both an access to the new knowledge and the examination of the quality of studies, which are competitive forms of training. K. Freeman emphasized the interdependence of such processes and noted that the technology affects every function within the firm, reforming it. After the spread of the technology its further development requires new forms of the network relations. A network form of the research activity eventually becomes the basis for subsequent formation of the formal joint enterprises and various informal cooperation networks [2].

## II. LITERATURE REVIEW

In view of the discussions about globalization of researches, specialization of agents of the innovation activity, growth of the mobility of capital, wide spread of IT technologies R. Rothwell identified five models of the formation of the innovation process. These models are: 1G "Technology push model" (sequentially linear model); 2G "Market model" (sequentially linear model); 3G "Coupling model" (nonlinear feedback model); 4G "Integrated model" (nonlinear model with parallel stages); 5G Networks and systems integration model (networking model). The main features of 5G model are [3]:

- enhancing general organization and system integration, which implies a parallel and integrated (cross-functional) development process, early involvement of suppliers in product development, attracting advanced users to product development, creating horizontal technical cooperation;
- more flexible organizational structures for quick and effective decision making;

- developed internal databases, involving the effective sharing of these systems;
- effective external communication channel: joint development with suppliers using computer-aided design systems (including in user interfaces), effective data transmission channels with R&D employees.

Making an analysis of the approaches used by companies for solving this problem Rothwell notes an emergence of the vertical and horizontal connections between firms and applying of IT instruments which form the basis for 5G model (networks and systems integration model). The use of these methods in organizing the innovation process brings advantages in the form of a greater market share, monopoly profits and increased customer satisfaction [3].

The 5G model is characterized by its unique organizational forms and instruments which include interaction ways of agents of innovation activity on the formation of streams of the results of intellectual activity and distribution of the functions along the value chain. This is about those types of contracts and deals which allow implementing open innovation as inside the innovation interaction forms as well as outside of them. Thus, the main forms of association of the innovation activity agents are: joint enterprises, strategic alliances, consortia and associations, joint venture financing and research laboratories, patent pools, clusters, etc. Key tools: outsourcing (subcontracting), licensing (including cross-licensing), equipment sharing, outstaffing, open content, crowdsourcing, etc.

The choice of forms and methods of interaction is determined by many factors, including technological features of industries, the extent of competition in the market, the development of the engineering services market, the prevailing type of intellectual property, the size of the organization, etc. According to, the results of the analysis of the «Research and development management in Russian companies» national report the most efficient implementation of the open innovation tools was spotted in the IT and biotechnologies industries with participation of the university-based small innovative enterprises and research institutes. In other words, aforementioned industries are industries with modern technological base. In opposite, developed industries with complex multicomponent resource base and high added value generated during the production process, do not have a widespread open innovations activity [4].

In conditions of total globalization and digitalization global economy observes an emergence of the new agents – leading multinational technology companies. These companies ensure global scientific-technological and innovation development by creating global informational, financial, marketing, management and production environment. Their main characteristics are: globalism, market dominance, high capitalization, flexible matrix structure and effective interactive management. Such companies globalize the market. One of their most significant functions is a creative destruction (J. Schumpeter) and transformation of the national, local, monopoly and oligopoly markets according to parameters of the saturations with innovations, price, service quality and profitability. Development of the “dominant

innovation” strategy is a distinctive feature of the leading technology companies. Such strategies are characterized by the signs of global, outrunning, long-term, highly competitive innovation activity [6]. Dominant innovative products have the following main characteristics: popular brand, unique features, multifunctionality and steadily high demand. Launch of these products on the market contributes to competition and optimization of production and management, stimulates economic activity, increases the efficiency of resources consumption, and increases share of the high-tech products and capitalization of the company and its overall productivity. Wayber explains this contribution by the law of increasing marginal returns which operates in informational economy [5].

Total globalization, highly competitive global market and presence of the multinational companies managed according to the innovation and technological leadership strategy make the question of development of the cost minimizing strategy particularly relevant for smaller companies which also use cutting-age innovation technologies (local innovators).

Studying peculiarities of entrepreneur behavior in conditions of the market disequilibrium J. Schumpeter described the role of entrepreneur as a role of entrepreneur-creator of changes (via creative destruction). At the same time, I. Kirzner studying the essence of entrepreneurship emphasized “alertness” as a characteristic which allows entrepreneur opening new opportunities when “human imagination saw a potential goal in particular situation or in use of a certain objects or resources in the new way which differs from the old one” [7]. The fundamental disagreement in the views of researchers is that J. Schumpeter considers entrepreneur as a creator of the future who produces changes in the system with his actions, but a manufacturer who doesn’t create innovations isn’t referred to entrepreneurs by Schumpeter, unlike Kirzner. According to Kirzner the essence of entrepreneurship is in identifying and fixing the mistakes in market situations related to innovations. In his opinion, it is a component of moving from disequilibrium condition to equilibrium.

In this way, economics agents in order to survive on the market are allowed choosing one of the two strategies of innovative behavior. They can either launch a completely new product (disruptive innovations) or chose an imitation strategy. In spite of the fact that Kirzner’s concept didn’t gain much of scientific “popularity”, the question of development and implementation of imitation strategies becomes increasingly relevant in modern conditions. Separate researches [8, 9] showed that companies forced to react to disruptive technological changes use imitation strategies borrowing new technological solutions from competitors.

In this context, where can be ideas for imitation got? What is the object of imitation? Who to imitate? When to imitate? What is the form of imitation? Are the key questions of the imitation innovative strategies?

All these questions are related to the problem of conformity (it is necessary to overcome a bound between original product and its replicate), its solution and final financial offer (cost-benefit ratio and expected rate of return). A large volume of information including nowadays relevant

monitoring of the digital footprint of industry leader company is required to answer these questions. Digital footprint is a collected data related to activity of the company in digital environment, which mostly used for monitoring of the competitors. For instance, there three types of imitation strategies: the «early adopter» strategy, the «chasing adopter» strategy and the “first importer” strategy. Every strategy requires companies to have different abilities and obligatory collection of information about the leader company. According to the research of L. Nowell [10] the «early adopter» strategy requires imitator to have developed imitative competences. Major players accelerate the launch of the new product by involving R&D department, while smaller players actively use the “time compression” strategy (mobilizing suppliers, technology transfer and intermittent development). The “chasing adopter” strategy does not require imitator to have developed monitor skills, because by the moment of the start of active imitation of a product or a service their concept is already well-studied. This strategy cannot be implemented without developed analytic skills because imitation has a deferred nature. Implementing the “first importer” strategy imitator has to have information about the features of external environment and to be able to run business on an international level in order to solve the problem of conformity.

It is necessary to note that in order to estimate the imitative potential of the company specialists use a group of methods for calculating economic efficiency involving the concept of a production-possibility curve (parametric stochastic, nonparametric stochastic, parametric deterministic and nonparametric deterministic). The following methods: Minimal Performance Inefficiency, Data Envelopment Analysis, Cobb–Douglas production function has different calculating principles but solve the same problem [11–13]. A production-possibility curve is calculated on the basis of parameters of the initial resources combinations (in general case these resources are labor and capital). After that, determination of the companies which “fixate” this curve called frontier occurs. Such companies are considered to be the leaders. The distance of lagging companies from the frontier is proportional to the opportunities for local innovation available to imitating companies.

### III. METHODS AND RESULTS

A research conducted to access the DEA-effectiveness [14–18] of Russian IT-companies’ performance (type of economic activity (VED) VED\_62: Software development, consulting in IT sphere) can be used as an example of evaluation of company’s imitation potential. The following financial indicators obtained from the “SPARK” information system [19] were taken as a basis of research: salary (S) (billion rubles) and fixed assets (FA) (billion rubles) as input data and revenue (R) as output data. A formed database has been used to assess technical efficiency (TE) of resource usage (INPUT-oriented) and efficiency of producing goods or services (OUTPUT-oriented) using DEA approach in case of Variable Returns to Scale coefficient (VRS). There has been determined leader-companies in terms of technical efficiency among 49 VED\_62 in 2017 (Table 1).

All leaders ranked by size which means they are leaders for large, medium and small companies respectively.

TABLE I. TE LEADER-COMPANIES VED\_62 2017Г DEA APPROACH

№	LgR	LgFA	LgS	Company’s name
1	10,93	9,86	10,10	«YANDEX» LLC
11	9,73	7,60	9,52	«IT CONSULTING» LLC
13	9,51	7,65	8,77	«CTI» LLC
15	9,40	8,37	8,49	«RAMBLER» INTERNET HOLDING
22	9,29	7,51	9,07	«OPENWAY SERVICE» LLC
34	8,97	7,66	8,16	«ELAR» JSC
41	8,72	8,15	7,79	«ATOMENERGOPROM» JSC
45	8,32	8,35	7,48	«KDI» JSC
47	8,17	7,50	7,99	«ALTERNATIVA GAME» LLC
48	8,13	7,62	7,54	«STT GROUP» JSC

A set of efficiency indicators is calculated by DEA method for each company. These indicators are the following: TE, proximate leader (pr), influence weight (wg), target value (TG).

“SAP SNG” LLC Company (№2):

- Enhanced efficiency OUTPUT ( $TE_{OUT} = 0,92$ ) has three different leaders of influence weight «YANDEX» LLC (№1) ( $wg = 0,77$ ), «CTI» LLC (№13) ( $wg = 0,11$ ), «RAMBLER» INTERNET HOLDING (№15) ( $wg = 0,12$ ), which allows increasing R from its current  $LgR = 10,51$  to corresponding efficient  $TG\_LgR = 10,59$ , which will increase R by 22%;
- In the INPUT case ( $TE_{IN} = 0,91$ ) proximate leaders are «YANDEX» LLC (№1) ( $wg = 0,72$ ), «CTI» LLC (№13) ( $wg = 0,11$ ), «RAMBLER» INTERNET HOLDING (№15) ( $wg = 0,17$ ), which will allow reducing costs from its current  $LgS = 9,76$  to corresponding efficient  $TG\_LgS = 9,68$ , i.e reducing salary by 17%; from its current  $LgFA = 9,44$  to corresponding efficient  $TG\_LgFA = 9,36$ , i.e reducing FA by 18%.

In this way, “SAP SNG” LLC Company (№2) both in OUTPUT case, and INPUT case oriented on «YANDEX» LLC (№1) in a greater extent and on «CTI» LLC (№13) и «RAMBLER» INTERNET HOLDING (№15) in a less extent.

«LUXSOFT PROFECCIONAL» LLC Company (№10):

- Medium efficiency OUTPUT ( $TE_{OUT} = 0,68$ ) proximate leaders are «YANDEX» LLC (№1) ( $wg = 0,34$ ), «IT CONSULTING» LLC (№11) ( $wg = 0,66$ ), which allows increasing R from its current  $LgR = 9,81$  to corresponding efficient  $TG\_LgR = 10,13$ , i.e will increase R by 110%;
- In the INPUT case ( $TE_{IN} = 0,53$ ) proximate leaders are «YANDEX» LLC (№1) ( $wg = 0,15$ ), «IT CONSULTING» LLC (№11) ( $wg = 0,38$ ), «CTI» LLC (№13) ( $wg = 0,47$ ), firstly, which will allow reducing

costs from its current  $LgS = 9,71$  to corresponding efficient  $TG\_LgS = 9,26$ , i.e. to reduce salary by 65%; secondly, will allow reducing  $LgFA = 8,36$  to corresponding efficient  $TG\_LgFA = 7,97$ , i.e. reducing FA by 59%.

In this way, «LUXSOFT PROFECCIONAL» LLC Company (№10) both in OUTPUT case, and INPUT case oriented on «YANDEX» LLC (№1) in a less extent and on «CTI» LLC (№13), «IT CONSULTING» LLC (№11) in a greater extent.

«INTER RAO-IT» LLC Company (№25):

- Efficiency is above average in case of OUTPUT ( $TE_{OUT} = 0,69$ ) proximate leaders are «YANDEX» LLC (№1) ( $wg = 0,05$ ), «CTI» LLC (№13) ( $wg = 0,26$ ), «RAMBLER» INTERNET HOLDING (№15) ( $wg = 0,69$ ), which allows increasing R from its current  $LgR = 9,21$  to corresponding efficient  $TG\_LgR = 9,50$ , i.e. will increase R by 97%;
- In the INPUT case ( $TE_{IN} \approx 0,68$ ) proximate leaders are «CTI» LLC (№13) ( $wg = 0,08$ ), «RAMBLER» INTERNET HOLDING (№15) ( $wg = 0,46$ ), «ELAR» JSC (№34) ( $wg = 0,46$ ), firstly, will allow reducing costs from its current  $LgS = 8,64$  to corresponding efficient  $TG\_LgS = 8,36$ , i.e. reducing salary by 48%; secondly, from its current  $LgFA = 8,25$  to corresponding efficient  $TG\_LgFA = 7,98$ , i.e. reducing FA by 46%.

In this way, «INTER RAO-IT» LLC Company (№25) in case of OUTPUT mostly oriented on average companies' leaders «CTI» LLC (№13) and «RAMBLER» INTERNET HOLDING (№15), in case of INPUT – equally on the leader of average «RAMBLER» INTERNET HOLDING (№15) and the leader of small «ELAR» JSC (№34) companies.

«ARKA TECHNOLOGIES» LLC Company (№43):

- Average efficiency in case of OUTPUT ( $TE_{OUT} = 0,40$ ) proximate leaders are «CTI» LLC (№13) ( $wg = 0,14$ ), «RAMBLER» INTERNET HOLDING (№15) ( $wg = 0,34$ ), «ELAR» JSC (№34) ( $wg = 0,52$ ), which allows increasing R from its current  $LgR = 8,64$  to corresponding efficient  $TG\_LgR = 9,19$ , i.e. will increase R by 256%;
- In the case of INPUT ( $TE_{IN} = 0,63$ ) proximate leaders are «ELAR» JSC (№34) ( $wg = 0,59$ ), «AITERNATIVE GAME» LLC (№47) ( $wg = 0,32$ ), JSC «STT GROUP» (№48) ( $wg = 0,09$ ), firstly, will allow reducing costs from its current  $LgS = 8,36$  to corresponding efficient  $TG\_LgS = 8,05$ , i.e. to reduce salary by 51%; secondly, from its current  $LgFA = 7,90$  to corresponding efficient  $TG\_LgFA = 7,61$ , i.e. to reduce FA by 49%.

In this way, «ARKA TECHNOLOGIES» LLC Company (№43) in case of OUTPUT equally oriented on the leader of average «CTI» LLC (№13) and «RAMBLER» INTERNET HOLDING (№15) and the leader of small «ELAR» JSC

(№34), in case of INPUT - on the leader of small «ELAR» JSC (№34)

«AVIAOK» LLC Company (№44):

- Efficiency is above average in case of OUTPUT ( $TE_{OUT} = 0,66$ ) proximate leaders are «ELAR» JSC (№34) ( $wg = 0,41$ ), «ATOMENERGOPROM» JSC (№41) ( $wg = 0,52$ ), «STT GROUP» JSC (№48) ( $wg = 0,07$ ), which allows increasing R from its current  $LgR = 8,48$  to corresponding efficient  $TG\_LgR = 8,78$ , i.e. will increase R by 96%;
- In the case of INPUT ( $TE_{IN} = 0,79$ ) proximate leaders are «ELAR» JSC (№34) ( $wg = 0,26$ ), «ATOMENERGOPROM» JSC (№41) ( $wg = 0,22$ ), «STT GROUP» JSC (№48) ( $wg = 0,52$ ), firstly, will allow reducing costs from its current  $LgS = 7,92$  to corresponding efficient  $TG\_LgS = 7,76$ , i.e. reducing salary by 31%; secondly, from its current  $LgFA = 7,91$  to corresponding efficient  $TG\_LgFA = 7,75$ , i.e. reducing FA by 30,5%.

In this way, «AVIAOK» LLC Company (№44) both in the case of OUTPUT, and INPUT mostly oriented on the leader of small «ELAR» JSC (№34), «AITERNATIVE GAME» LLC (№47), «STT GROUP» JSC (№48).

#### IV. CONCLUSIONS

The results of using this group of methods contribute to identifying companies whose development is possible only within the framework of an outrunning strategy. For other companies, the results will allow abstracting the reference group, choosing the optimal technological trajectory that contributes to the fastest technological alignment in the industry and the move to technological breakthroughs within the framework of the recommended development paths. The practical result will be presented in the form of technological development in industries and the increase of the economic efficiency of companies, regardless of their current economic situation.

According to M. Porter the feature of the strategy is its uniqueness as performance, as the result and as unique set of values. Given description doesn't correspond to imitation because it definitely means borrowing from the others. Yet Sh. Oded noticed that: "...imitation can be derived from several activities, while having clear differences in form or combination architecture.... It has an ability to create unique value, especially in combination with innovation, and sometimes by itself. .... import and adaptation of ideas, working methods and models, complementing innovation and imitation and creating from them a "mixture" with unique characteristics, not only supports the core business, but also strengthens the main competitive advantage of the company" [10].

#### ACKNOWLEDGMENT

The research is conducted with financial support from Russian Foundation for Basic Research (RFBR) in the frames of scientific and research project of RFBR named "Local

innovations and global technological leadership: Rethinking the approaches to effective inter-industry technology transfer,” project №. 19-010-00946 (a).

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