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IS TECHNOLOGICAL LEADERSHIP DECISIVE FOR COMPETITIVENESS?

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Abstract

The literature dealing with technological changes is very diverse and voluminous. It covers different areas of researchers' interests, such as: analyzing either technological capabilities or achievements, measuring new technology diffusion, innovative inputs and outputs and their impacts to productivity rise, studying the importance of technological changes for endogenous macro growth and so on.

Approaches based on results of endogenous growth theory, as well as analysis derived from national innovation systems' theory, were exactly those which emphasized that national technological capability can be understood as major source of international economic competitiveness. They rest on the following ideas: greater initial stock of knowledge enables achieving higher level of productivity, whereas more human capital (devoted to research and development) produces increase of country's innovativeness; innovations (even less significant ones) reduce production costs, this way positively influencing competitiveness of the country on global market.

It seems that technology and competitiveness represent two sides of the same "coin": this way technology turns out to be the instrument of inducing global competitiveness, whereas taking part in globalization processes appears to be impossible without technology progress. As it was noticed a long ago, global competitiveness (wide "spectrum" of advantages one country possessed) represents the result of diverse strategies carried out by corporations and national economies. That is why in this paper we wonder whether those countries achieving the greatest growth during last fifty years have something in common regarding technology development strategy, but also ask ourselves can other, developing economies, rely on and "copy" (at least partially) the above-mentioned examples.

Key words: *technology, development, competitiveness.*

Instead of introduction: changes in the concept of competitiveness

Fifty years ago the measure of competitiveness was exchange, i.e. trade, and some country considered to be competitive if its export exceeded import. Changes in the concept of competitiveness were caused by practical as well as theoretical reasons. First of all, technology gap analysis gained in importance when researchers realized that technological development has become significant factor in determining long-term growth rates [6, p. 391]. At the time, regarding the progress of science, Europe was late after the USA for, at

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least, two decades.[1] According to economic analysts' opinions, it can be ascribed to application and use of available technologies [6, pp. 396 – 398]. Also, integration of science in trade models started when researchers realized that HOS model neglected technology as important component of international exchange. The term technology competitiveness[2] arose exactly during discussions concerning technology gap between Europe and USA.

Obsession with international competitiveness [10, p. 44] culminated in the USA twenty years ago; comparing to earlier period the only thing that has changed was the name of American "satellite " – Japan (instead of Europe), which had got comparative advantage in producing technology intensive products. At the time use of the following attributes (connected to the term technology) was intensified: basic, advanced, new, strategic, emerging [7, p. 1222]. These types of technology considered to be "responsible" for structural economic changes which may decisively influence competitiveness of enterprises and national economies.

Owing to actual trends in world economy, international trade theory passes through the period described as "paradigm shift" (including explicit recognition of importance that technology has for past and present trade patterns) [5, p. 542]. Although changes in techno-economic paradigm were in the past also followed by changes in international division of labor, technological leadership nowadays seems to become dominant element of competitiveness (which was confirmed by empirical results for developed countries) [3, p. 43]. What has changed in the meantime regarding the analysis of technological gap, was the insisting on measuring contribution of science and technology (mostly information and communication technology) to economic growth, as well as introducing the *benchmarking*, which enabled any country to compare itself with the best ones and to comprehend its relative position (for example, in relation to average result of developed countries) [6, p. 407].

It has been noticed, in that sense, that benefits from different technological achievements were not equally distributed – they diverged across countries and regions a long ago. Being concentrated in England, those benefits were spreading to West Europe, and later to the USA, which were usually said to invent "the process of invention itself" [2, p. 31]. The USA drove Europe from a "throne" owing to mass production and energy intensive products. Later on Japan penetrated into information technologies, this way taking the lead. Transforming its appearance, Japan actually made "revolutionary" action regarding the strategy – from that one directed to use of comparative advantages to the strategy of creating competitive advantage (so-called managed competitiveness).[3] Its example was followed by those countries realizing that competitiveness seemed to be more matter of strategies that the product of circumstances [14, p. 5]. Using different technological strategies helped some of them to achieve high growth rates as well as to improve their competitiveness.

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[1] These results were treated as lagging behind (not like a gap). The gap is understood as inequality arisen at exact moment, i.e. vacuum which is somehow supposed to be fulfilled. Bearing in mind that uniform technological level as such has never existed, this explanation sounds not quite precise. In contrast to it, leadership and lags are usual phenomena, replacing each other very often [6, p. 397].

[2] This notion was meant to explain phenomena previously known as research intensity. As the time passed by, high technologies became systematically used as synonym for technology competitiveness (intensity) [7, p. 1225].

[3] Competitiveness is broader term than comparative advantage; it can't be asserted that one country is competitive because of comparative advantage it possesses (this would mean that those not possessing such advantages can't be competitive at all, which makes explanation of results achieved by Japan, Switzerland, Germany and similar countries questionable). Out of these reasons, competitive advantage is determined as next stage of dynamic comparative advantages [12].

Strategies of technological development (a review)

The USA, Japan and Europe has been dominated on the world scene for a long period, simultaneously reacting in appropriate way to current challenges and creating the new ones. According to structural competitiveness criteria, even five group of countries aspired at the time to become active participants on the market (already "shaped" by the above-mentioned "actors"): a) Hong Kong, Singapore, Korea and Taiwan; b) Malaysia, Filipinas, Thailand**;** c) Argentina, Brazil, Mexico; d) Chile, Columbia, Uruguay, Venezuela; e) China and India. First mentioned group of countries also abandoned comparative advantage concept (based on large supply of cheap labor and development of sectors such as shipbuilding, steel and textile industry) in 1970's. Japan's success gave them a stimulus to direct towards competitive advantages (based on mobility of technology, capital and qualified labor). Although they also applied strategy of import substitution of industrial products (in order to attract foreign direct investments which could help in producing previously imported products), these trials turned out to be inefficient ones comparing to strategy of import substitution of raw materials and intermediates implemented by developed countries (this way they became less dependent on import from developing countries and their decision caused decreasing in demand for primary products).

Obviously, it took a while for noticing that such approach, only in combination with some long-term strategy of created competitiveness, can be helpful. That is why Korea, for example, decided to apply "mix of concepts", i.e. combination of different strategies. It used strategy of imitation of so-called low end products, organizing production based on available resources (especially in producing TV sets and computers), so that revenues acquired through large quantity later on could invest in high technology development. Speaking of strategy of components' production, it can be implemented in countries abundant in qualified labor and with appropriate infrastructure (such as Korea, Singapore, Malaysia and Thailand, which penetrated this production a long ago or, like India, in the case of software). Korea is also known by using strategy of technological "jumps", i.e. instead of being occupied with standardized products and not to accelerate industrialization so that it could develop sectors characterized by comparative advantages, this country entered pre-standardization phase, and achieved great results thanks to complementary advantage (factors of non-price competition) it possessed comparing to leaders. Many countries, such as Korea, Taiwan and other new-industrialized ones, accepted strategy of vertical market segmentation; they converted to electrical engineering products (meant for some regions in developing countries, because their consumer demands were less sophisticated than those ones from developed countries).

Actually, just a couple of economies step forward from developing to category of developed countries (thus far progressed Hong Kong, Korea, Singapore and Taiwan).[4] These economies succeeded thanks to diverse strategies of technological development they were applying. Korea went its own way of autonomous technological development (this concept is similar to Japan's example); at the beginning it acquired technology through trade, imitation and licenses, later on started investing in research and development so that it could develop own technology (comparing to other above-mentioned countries it less relied on foreign direct investments and devoted its efforts to high education development). Hong Kong chose liberalist concept and along with Singapore it represented one of countries

[4] Recently, this step forward is distinctive feature of China and India, as well.

highly depending on foreign direct investments; however, regarding the access of knowledge, it lagged behind other three countries since it introduced pro-active approach (concerning investments in research and development, high education and information and communication technologies) later (not until 90's). Singapore also had an open trade regime and it almost simultaneously became regional hub for knowledge-based services (finance, education, health care) and center of regional multinational headquarters. Taiwan decided on some kind of "middle way" – a solution in-between strong industrial policy of Korea and more open, although governed and directed, Singapore's concept. That is why its "path" could be labeled as state directed technological development [2, p. 38].

Consequently, during last couple of decades, only several developing countries succeeded to achieve such growth rates which narrowed the gap between them and most advancing economies.[5] Keeping in mind that general review contains large number of variations in achieved growth rates (both across locations and through different time periods), Rodrik [13] insists on the claim that growth promoting politics (so-called growth strategies, i.e. economic policies and institutional arrangements directed to catching up to developed countries regarding standards of life) should be context-specific ones. Inducing and maintaining the growth require quite different things [13, p. 3; 5, pp. 542 – 543]: the former rests on limited and unconventional reform's tasks, while the latter is much difficult (it demands creating of institutional support; such an action certainly takes a lot of time).

Speaking from technological strategy standpoint, success of leading countries was rather achieved owing to long-term policies they applied during last decades, than due to short-term effects (based on their advantages in relative production costs). Strategy of stimulating export of labor-intensive goods, followed by gradual turn to more sophisticated products [2, p. 46] seems to be (in case of countries of East Asia) the right "recipe" for success. However, imitating their strategy is no longer feasible, at least out of these two reasons: first, overall changes in global world are almost dramatic; second, speed of China's penetration took specific form and dimensions, preventing use of simple strategy of growth based on labor-intensive activities (China is obvious example that, besides low costs, high productivity as well as large-scale economy applied in delivering and logistic represent necessary conditions for making a success). These facts confirm that strategies are also context-dependable [11, p. 8]. Besides, nowadays is (more than ever before) obvious that technological catching-up forces former leaders into continual improvement in that regard (technology progress perpetuation – 3, p. 44). That is why permanent disequilibrium in international trade is believed to be rather rule (and not the exception to it), so no wonder that technological leaders achieve surplus while, at the same time, developing countries tend to fall into "spiral" problems [5, p. 565].

What have we learned: is technological competitiveness decisive?

Under the circumstances characterized by fast changes, developing countries are facing with really severe competition on the world market (they are more exposed to influence of

[5] The other group of countries belonging to East Asia (which also were very successful, like Indonesia, Malaysia, Vietnam and Thailand), showed much compactness regarding conceptualization and application of their economic and particularly technological strategies. With the exception of Indonesia, in other countries foreign direct investments have been of crucial importance for export growth

major global trends).[6] On top of everything, they are supposed to be more capable (than ever before) in order to respond to new opportunities and threats quickly and appropriately [2, p. 49].

At the same time, due to stronger regulations of international trade system, some forms of industrial policy, as well as protectionism, are no longer allowed (according to the rules of World Trade Organization). Developing countries found themselves in much difficult situation, being deprived of the opportunity to apply those strategies which helped certain economies to acquire advanced technology [2, p. 48].

If developing countries emulated USA as example, they would be expected to pay attention to research and development (as the main component of growth). However, their innovative capabilities are not up to that task. In fact, only 15 % of world population provides almost all technological innovations. On the other hand, one third of population (approximately) is deprived of either innovation-creating or accessing technologies developed elsewhere [9, p. 635].

That is why economic analysts suggest them not to deal only with creating of knowledge, but to be occupied with acquiring, adaptation, dissemination and use of knowledge [2, p. 32], i.e. incremental technological changes [1, p. 25]. So, all those economies trying to exploit advantages of founded knowledge and its application (through adaptation and reconciliation with local circumstances) are supposed to use trade and technology transfer to achieve their goals. Apart from this, they are expected to improve so-called technological absorptive and adaptive capacities (referring to literacy, education attainment, macroeconomic stability, business climate, governance – [8, p. 8, 81]).

Is practically feasible for developing countries to rely on incremental technological shifts? Or, does the lack of technological competitiveness (based on innovativeness and defined as capability to compete successfully on markets for new products and services) represent important obstacle to make progress in global competitiveness score?

These are questions Fagerberg and others [4] were interested in. Respecting Schumpeter's "logic" (technological competitiveness dominated other types of competitiveness, particularly a price one), they created growth model in which GDP of a country represented the function of its technological knowledge as well as capabilities to "exploit" benefits of its use. The increase of country's market share will, in such conditions, depend on the following factors: its potential to exploit knowledge developed somewhere else (it depends on the level of country's technological development relative to the world average); creating of new knowledge (technology) in the country relative to competitors; increasing of the capacity of exploiting knowledge (no matter where it was created), also in comparison with competitors; changes in relative prices [4, p. 5]

Having presented data concerning levels (initial level of productivity – GDP per capita) and trends (average growth rate for the period 1990-2002) and working these aspects out, authors noticed following things concerning developed countries: some of them are positioned above average level of GDP per capita having at the same time slow growth (Japan, Switzerland, Germany), so they are labeled as those "losing momentum"; others, apart from high level of GDP per capita, continued to grew - they "move ahead" (Hong Kong, Korea, Singapore, Taiwan, Israel, Ireland). Speaking of developing countries, there is clear distinc-

[6] Trends that shape and change global competitive surroundings are the following ones: trade liberalization, higher speed of knowledge-creating and its disseminating, more significant role of multinational companies, changes in competitive factors and so on.

tion between countries going along catching-up trajectory (China) and economies "lagging further behind" (like ex centrally-planned ones).

The above-mentioned paper insists on difference between technological and capacity competitiveness (this one is considered to be determined by technical and organization competency (level of education), availability and quality of financial institutions and markets as well as efficiency of governance). Comparing to technological competitiveness, capacity to exploit (technological) opportunities turned out to be more convergent, because a lot of low-income countries (like Romania, Peru and China), not to mention middle-income ones (such as Slovenia, Portugal and Poland), succeeded to catch-up. Also, comparing the level and trend of technological competitiveness with trend of GDP per capita, the former turns to be more divergent than the latter [4, p. 10].

Therefore, worsening of technological and capacity competitiveness, along with inadequate export composition appeared to be the most important factors preventing less developed countries to exploit their catching-up potential regarding technology and income. Speaking of technological competitiveness, there is clear divide between advanced economies (characterized by continual growth) and the rest of the world which, at best, experienced stagnation tendency (digital divide is considered to be the main cause of such differences). Although some low-income countries accomplished rapid growth rates, their results were mostly based on proper using of diffusion potential and low cost strategy. That is why they are expected to face with lagging very soon, i.e. it is quite certain they couldn't escape troubles concerning both capacity and technology.

The above-mentioned results contradict those offered by Global economic prospects. Also, we couldn't draw from them conclusions similar to the advice usually given to developing countries by economic analysts. Precisely, existence of technological divergence kept to be justified the following way: in spite of being much more exposed to external technologies, developing countries didn't exploit opportunities due to constraints in their technological absorptive and adaptive capacities. This explanation, obviously, forgot things concerning actual state of affairs. For example, although globalization produced some positive changes (regarding the flow of goods and services) it also resulted in no significant technology transfer to developing countries. Actually, the situation become more complicated when global and local aspirations are interwoven and confronted: selling of technology represents the way of promoting technological dependence on the global level [9, p. 642]. Besides, technology transfer is, in a certain extent, limited, i.e. developing countries were usually offered more or less obsolete technologies.[7] On top of everything, comparing to advanced technologies used by most developed countries, developing economies experience enormous lagging that even abundant supply of cheap labor can't compensate it [9, p. 632].

Therefore, poorer countries nowadays have less chance to fulfill development gap (their markets are not investment-attractive, so that developed economies find no reason to deal with their needs). Enormous progress of some countries previously was based on absorption of innovation invented in industrialized economies. However, even in that respect there is a difference between countries from Latin America (such as Brazil and Mexico) which applied passive learning strategies (causing incremental changes in adopting technologies) and economies from East Asia (Korea and Taiwan) relying on active-learning strategies (as necessary but not sufficient conditions) which stimulated them to put resolute

[7] Technological changes can either increase competitiveness or "erode" it. Precisely, owing to diffusion and technology transfer, technology change may cause equalizing or disrupting of competitiveness.

efforts into improvements concerning education, research and development and innovation. Today, transfer from passive to pro-active concept looks like moving in vicious circle: local innovations are not feasible without access to the world market whereas entering such a market seems impossible with no technological innovations [9, p. 638].

Conclusion

Technological capabilities are considered to be the main component of economic growth and prosperity. However, in spite of international trade, foreign direct investments, conceiving of policy which may induce cooperation and other channels of technology transfer, mere production of knowledge seems to be concentrated in several highly industrialized countries (technological capabilities being this way unequally distributed across enterprises, regions and countries).

In the past, transfer of technology was enabling overcome of entry-barriers in some markets, causing export restructuring from labor and resource-intensive products to those ones based on differentiation, large-scale or technological intensity. Owing to it countries from East Asia entered the group of so-called new-industrialized economies.

However, speeding up of technological changes and more additional preconditions (less developed countries have to fulfill in order to participate in mentioned trends) complicate the circumstances day after day. It is much difficult for “outsiders” to approach the world market because technological progress (which dictates conditions of their appearance) causes arising of obstacles they can come across. That is why any recommendation, which suggest developing countries to pay their attention exclusively to development of so-called national absorptive capacities (so that they can “trace the road” to global technologies), sounds a little bit boring. In fact, economic analysts claim, from one side, that national as well as global competitiveness are predominantly defined by micro technological competitiveness (i.e. innovativeness) while, from the other side, pretending to be well-intentioned advisers they recommend developing countries to take care only of incremental technological moves (which, for certain, can’t initiate significant influence on competitiveness).

Apart from key elements of economic policy developing countries themselves created or adopted (in regard to scientific research and technological innovation), some additional requirements have to be fulfilled so that they could solve their problems properly. In that sense, developed countries are expected and supposed to support their efforts and make carrying out of their plans easier.

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