CATCHING-UP DEVELOPMENT OF THE FOLLOWERS

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Abstract:

Developing to catch up with leading countries is always the desire of the followers. These are also phenomena that have occurred at different periods in history. The characteristic of catching-up development is to make a difference in the way implement its development as to eliminate the gap in the level of development or the position in development pathway.

Although the capacity in scientific research and technological development is still modest, the followers can improve their national science and technology (S&T) capacities through enhancing of applicability of S&T in production. The follow-up countries can exploit the differences between capabilities that are suitable for current context and those that are suitable for future requirements. Technical and S&T related economic development often changes over time. A good preparation of these abilities for catching-up development will enable the followers to rise up and catch up their ahead leading ones.

Keywords: *Economic development; Catching-up development; S&T capacities.*

Code: *17031401*

Development often occurs unevenly across countries. While some countries have made strong strides and occupied top positions, many others are slow to move and be lagged behind. The leading countries have created the gap and scale of development. The goal of moving forward is not just to compare with themselves but also to the world. Eliminating the gap lagging and rising to the top is always the desire of the followers.

How can a lagged country catch up and rise to the frontier in economic development based on S&T? The answer to this question should arise from the successes that have taken place in history.

1. History in a glance

Historically, there have been examples of catching up and surging in economic development associated with technique, science and technology.

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Roman vs Greece

From the 4th to the 2nd BC, Greece achieved a very high level of scientific and technical development. Thanks to their scientific reasoning mindset and their combination of scientific and engineering techniques, Greece overpassed other nations. However, in the middle of the 2nd BC century, the Romans with their invasion of Greece, developed their technical achievements to the higher level. Historians noted that the Romans, with their organizational and managerial and managerial advantages and pragmatic mindset got large profits from the Greek technical achievements for development off the economic system... The Romans had no significant contributions on scientific achievement as much as those achieved by the Greeks, but their stone mark in the technical history was the application of Greek technical achievements on a large scale, with also significant improvements during the applications such as in metallurgy, knitting, silver plating, gold plating, and some semi-mechanized equipments such as flour mills, edible oil presses, water wheels, lifting equipments.

Thus, it could be concluded that the Romans developed through the application of S&T into production.

Europe vs China

In the first millennium, China had grown stronger than other continents. By the end of Middle Ages, Europe and China had the same technical level, after that Europe rose strongly and surpassed China.

In addition to the factors related to political and social environment[2], one important factor for the rise of Europe over China in the 18th century was due to S&T, which was created in an "European" style that could not be grown in those places like China. Although the former practical effect of applying individual S&T achievements in China was much higher than those of Europe, the situation changed with the new revolution of science-based technology. China's engineering system was a quite complete system in comparison with European technical systems... But the technical system was characterized by a lack of mechanical engineering. In particular, the most important and widespread defect of this technical system is the lack of scientific support and of rational and empirical scientific thinking to refine the old techniques arised from the experience of production and to create new techniques as required by the production. China's scientific theory did not come from objective experiments, it did not combine mathematical processes with natural processes to be quantitative and unpopular enough to

[2] In China, the political and social environment restrains the development of S&T and the application of S&T into the economy. In contrast, Western countries through the Renaissance and religious reforms have facilitated the development of S&T and the application of S&T to the economy…

be tested and validated in the application to renovate the world... In the meantime, at the end of the Middle Ages, Europe began to criticize the scholarly tradition and advocate for experimental sciences.

At the same time, the application of S&T to production in Europe was stronger than China. Will Durant in his book "The History of Chinese Civilization" remarked: "The Chinese are more inventive than exploiting their inventions..." Thanks to the proactive application, the technologies were constantly improved, which can be clearly seen through a comparative example of printing techniques. At the beginning of the 15th century, China and Europe had almost the same level of technical development in printing. But after the invention of modern printers by Johann Gutenberg, Europe developed fast while China did not. The success of Johann Gutenberg was mainly the fact that he did not only included just individual innovations or improvements but integrated all the elements of printing techniques in an efficient production system. What he developed was not just a machine or tool, but a complete production process.

Germany, USA vs UK

In the Second Industrial Revolution (1871-1914), some countries like Germany and United States caught up with the growth of UK. The term "Second Industrial Revolution" was also used in the sense of enhancing the role of Germany and the United States and at the same time lowering the role of the UK.

The catching up and surpassing of Germany and United Kingdom over UK was because they have grasped the opportunities for open development. It was a period of strong development of railways, ships, electrification.

At the same time, the application of S&T to production in German and US was also better. In UK, not only the wave of inventions collapsed, but also emerged the phenomenon that many inventions fled to other countries and used in America and Germany.

Japan vs America, Europe

As a follower country, Japan has caught up with US and Europe through efforts in applying S&T achievements into production. The clear characteristics of Japanese applications are very creative. Japan integrates research and development activities with the importation of foreign technologies, especially those of United States, in order to master, adapt and enhance those technologies for economic development and re-export abroad even in the countries that created these technologies. The cost of Japan to buy foreign technology was not very costly; for the past 30 years (1950-1980), it costed about $10 billion; but by the early 1970s, Japan's technological level

had surpassed that of Western Europe and in 1977, if the commission charged for inventions were excluded, Japan's technology exports had surpassed technology imports (*Hoang Dinh Phu, 1998, pp. 155-156*).

Another effort of Japan is to seize the opportunity on the trend for growth. In the late 1970s, both government agencies and social actors were all oriented towards the industrial revolution that began to take place: optical-electronics, mechatronics, composite/ceramic materials. In fact, the radical and strategic shift of Japanese corporations started from this point. The NEC, Mitsubishi Electric Corporation, Toshiba and Taray have positioned their developments on these new technologies, thus dominating the world market.

Some studies have indicated that Japan has increased the competitiveness of its industry and economy by developing unique technologies, especially by improving core technologies and by experimenting as the basis for increasing its competitiveness. National projects such as nuclear energy development and space operations were promoted in the 1960s to become large-scale projects, because these fields would play an important role in developing technologies as a technology frontier; and the achievement in these areas will induce great impacts on other areas. By 1960, Japan had set a 10-year goal for science to reach a research level that allowed the country to conduct international exchange and cooperation on an equal basis or in a higher position, creating an important foundation or basement for Japanese industries that did not depend too much on foreign technologies[3].

2. Characteristics of the catching-up development

History has shown that there were possibilities for catching up and breakthrough in economic development associated with S&T. The core issue is to make a difference in the way implement development in order to eliminate the hierarchical level and position of development.

The distinction between countries at the forefront and countries in the latter position in economic development associated with S&T can be reflected in the indicators reflecting the level of economic development, S&T development and the level of close integration between S&T and production. However, these indicators are just superficial; the foundation is of national S&T capacity of each country. Exceeding in economic development related to S&T is often based on superior national S&T competencies. The catching-up development of latter countries depends on filling the gap in these capacities. In fact, it has shown the ability to fill the gap of national S&T capacities could be done

[3] *History of Japan S&T policy*. Hanoi, Labor and Social Publishing House, 2004, p. 122-123

through increasing the capacity of individual departments and preparing the capacity to anticipate opportunities in the future.

Enhancement of capacity of application science and technology for production

National S&T capacities include the capacity of scientific research and technological development and S&T application capability in production. Although the capacity of scientific research and technological development is still modest, the latter countries can expand the national S&T capacities through enhancement of S&T application capability in production. Initially, the state of equality in S&T capacities will generally be formed if the level of S&T application capability in production offset the inferiority of R&D capacity.

It is worth to note that the history observed the change of position among leading nations in S&T development process. According to one estimate, from the 16th century to the present, scientific centers in the West has been constantly changing with the average cycle of scientific prosperity around 80 years. Italy took the lead in science from 1540-1610; UK was from 1660-1730; France was from 1770-1880; Germany was from 1810-1920 and United States has been from 1920 until now. From here, it is possible to draw implications for S&T applications of developing countries. So far, the changeover is still the story of the internal development of traditional leading countries. Not easy to becoming the number one in S&T development also means focusing on the other direction of S&T application. At the same time, there is a difference between the throne of S&T development and the pioneering position in industrialization. When British Industrial Revolution occurred (in the late 18th and early 19th century), UK was not the leading S&T country. By the time France and United States conducted their industrial revolution, they must be the leading in S&T... The difference is the ability to apply S&T results into economic development. For example, many inventions in UK during the industrial revolution also have appeared in a few countries, or even earlier than in England. For example, the steam engine was invented by self-taught inventor I. Polzunov at Barnaul in 1763, sooner than James Watt. A weaving table system with water-powered engine was built by an entrepreneur R. Glinkov (1760) longtime before Richard Arkwright...

In another example, in the industrialization of 18th century, Germany used a wide range of British machinery and foreign inventions. Since 1798, in Germany, the first blast furnace was built in Germany, cooking cast iron with coal fuel; from 1825, it began to apply ore crushing method; steam machines were also shipped from England...

S&T application activities and S&T application capability are inherently diverse and associated with the economic circumstances of each country,

region and locality. The ability to apply S&T promoted will make a difference, creating economic competitiveness.

Not only contributing to the expansion of national S&T capacities, S&T application capability in production also has an impact on upgrading S&T capacities. That is also necessary because although the application is very meaningful, there are limits. Especially, it is not easy to exploit technology from outside, even in the context of globalization as strong as today.

The catching-up development will really be achieved with the efforts both in terms of scaling up national S&T capacities in general and enhancing the capacity of scientific research and technological development in particular. This is supported since there are always possibilities being able to develop S&T capacities as there are no general limits on scientific research and technological development, as Samuelson remarked: "It would be wrong on science when supposed that all generations had come late to the party when it was over. The work of science is never finished. Science is a mobile party. A problem solved will blow up many new questions to be answered" (*Gerald M. Meier, 2003, p. 20*).

Catch of opportunities in the future

Besides exploiting the difference between S&T capacity and S&T application capability, follower countries can also exploit the difference between the capacities that are suitable to current context and the capacities that are suitable to the future. Economic development related to S&T has changed over time. The changes that took place were the opportunity for chaos between nations, through which the later came up to catch up with the earlier standing ahead.

The new situation requires new S&T capacities. A national S&T capacity is well promoted under current conditions but may be reversed in the future. The ability to catch up of the later countries depends on the efforts to find S&T capacities that are different from what the leading countries currently have; it depends on the effort to build up S&T capacities in anticipation of future opportunities.

It should be emphasized that there is a difference between the development through gradually shortening the gap and the development of front waiting in terms of orientation and evaluation criteria. It is not possible to take the level of development of shortening the gap to consider the front waiting development - which is judged by the ability to seize opportunities in the future. While the development of shortening the gap is substantially for the followers to imitate what the frontier countries have explored; in front waiting development, there is a competition among countries independently to their current rankings, and all look towards to the new.

A direct relationship in the way of quantity changed - quality changed between the two types of development is not clear. Efforts to shorten the distance do not necessarily constitute a small step in the front waiting development. There may be an indirect relationship through enhancing the national S&T capacity, strengthening the country's economic potentials...

One cannot be integrated these two types of development into one; but they are also not absolute independent. A decision of front waiting development has some negative effects on the development of gap shortening and vice versa. It would be a complement relationship in terms of concentrating resources and a differentiated relationship in terms of development directions...

Thus, the catching-up development is essentially a disturbance of available orders, which is related to other disturbances in terms of contexts, level of development,... In the catching-up development, what important is not the lagging gap, but the chances to catch the opportunity attached to the new coming trends.

Types of the catching-up development

The catching-up development of the follower countries is made by carrying out one of the aforementioned methods and also by a combination of them.

Catching-up through the development of S&T application capacity often faces with many difficulties when S&T capacities have to be strengthened to reach the same level as those in advance in the technology sectors that the former countries have been holding. Catching-up through grasping opportunities to front waiting often faces difficulties when S&T capacity must be strong enough for new technologies. It is important to be wary of the notion that there is a historical development that is creating opportunities for later countries and the advantage lies in their backwardness. Toffler's view, for example, is that countries in the first wave embrace the third wave more favorably than those in the second wave. In fact, these sound logical arguments have not yet been confirmed in practice. On the contrary, in order to develop strongly, later countries still need to build up its S&T capacities. Pasteur's motto is more relevant here: "Randomness only benefits the prepared brains".

These difficulties are directly proportional to the lag of later countries. At the same time, the combination of the two types does not necessarily increase, but, on the contrary, can alleviate the difficulties.

Japan is a good example of this combination. It is suggested that Japan's mode of development is mainly to import technologies (distinguishing to those countries focused on basic research, creating technology to serve the economy like the US, the former Soviet Union, some Western countries, as well as to those countries that have both carried out basic research to create

technology and imported technology from foreign countries such as India and China) *(Hoang Dinh Phu, 1998, p.144)*... In fact, Japan is not only focused on technology import (associated with S&T application capability), but also in capacity to catch up. Even so, there have been periods of scientific research in Japan that have achieved theoretical excellence but were still inferior to those of developed countries in the field of applied or experimental sciences. Recognizing this, Japan has made efforts in the development of applied science as a key focus.

There may be two types of combinations: continuous and parallel. Continuous combination is the development of S&T application capacity in order to build S&T capacities, not only in the technology sectors that are already hold by the forefront, but also in anticipation of emerging technologies. Parallel combination is the simultaneous existence of two modes in the economy, each implemented in its own field or area. Parallel combination is to enlist conditions and coming opportunities which are essentially differentiated between sectors and areas in the economy.

3. Catching-up development at the current state

Today, a new generation of S&T-based economic development is being witnessed of the catching-up countries to the leading ones, typically in NICs such as China and India. This is the process that has already taken place and has not ended yet. With the signs of the front waiting development in the NICs like China, India, etc., some scientists have raised the question whether Asia is the place of the new S&T revolution. This reminds of a historical period with the rise of Europe and the UK in the 18th century, thanks to the formation of a "European-styled" S&T.

In fact, some Asian countries have been very actively preparing their national capacity for new coming development opportunities. From 1995 to 2005, China doubled the share of scientific research in GDP, from 0.6% to 1.3%. Korea's scientific research budget also increased from $9.8 billion in 1994 to $19.4 billion in 2004.

High-techs that are capable of leading the future have been focused in the country's catching-up development plan. For example, in South Korea, the strategic objective of Biotechnology Program 2000 is to bring S&T capability in the field of biotechnology to the level of the world's leading countries. South Korea aims at becoming one of the five most powerful biotech countries in the world by 2012. Not wanting to miss the biotech ship, Singapore has been "attacking" biomedical sciences since 2000 and has been emerged as a regional leader in biotechnology and a global competitor in the field since then. Singapore's vision is to become a biopolis hub in Asia. In India, the information technology and software industry has

emerged as one of the fastest growing sectors of the economy. Along with them, there have been impressive strides in nuclear technology, biotechnology, mobile phones, etc. The Indian government has set a target of becoming a developed country by 2020. At a conference in Mumbai on December 23rd, 2005, the President of India A.P. Kalam stated that India has been on track to become a knowledge power and play a leading role in the intellectual revolution. China is also aspiring to be a technological superpower through a leaping strategy to accelerate its capabilities in the IT industry by deploying new operating systems associated with advanced software programs and CPU chips. In the area of biotechnology, China will focus on areas such as functional genomics, bioinformatics, biomedicine and plant breeding by genetic engineering, with the goal of being recognized in the international biomedical industry.

Compared with the previous period, the striking feature of catching-up development in this period was: the gap to the leading countries is larger - which is the gap between developing and developed countries; the way in which development is emphasized in anticipation of new technologies and enhanced the technology application capacity is not so striking as to make a difference that creates advantages over the leading countries. The characteristics of current catching-up development are related to the characteristics of the contemporary context. S&T revolution taken place with breakthroughs provided many opportunities for the front waiting development. The new technology also requires the national S&T capacities that do not need much construction compared to the previous historical period. For this point, Toffler's comment that the countries in the First Wave embark on the Third Wave more favorably than those in the Second Wave seems to be justified. At the same time, economic and S&T globalization allows developing countries to attract resources from outside to enhance their national S&T capacities. For example, in China, the number of foreign R&D agencies increased from 0 to more than 700 in a decade; 885 research and development projects were carried out in Asia between 2002 and 2004; 723 projects (over 80%) were conducted in China and India.

Despite of favorable conditions, the challenges for catching-up development are still numerous. First of all, seizing the opportunity that emerges from the S&T revolution is often not simple. In India, though, science has always been promoted, as Prime Minister Abdul Kalam once said: “Science brings two major changes to life. First, science is a way of thinking that transforms people. Second, when science has turned into technology, it can bring rapid development into the nation. That is why, since 1947, S&T have always been the top priority of all governments”;

however, India was considered to be late in the microelectronics revolution in the 1970s and 1980s due to a lack of investment at the right time and should be more clear-sighted in the 1990s when nano-science emerged. Other difficulties related to national S&T capacity building. There are many factors to consider in the national S&T competency for catching-up development:

- Building the necessary national S&T capacities, it is necessary to have great determination and unity in the leadership of the country and in the society. It is necessary to make use of all resources, both directly and indirectly, internally and externally;
- Developing the national S&T capacities to meet the demand of front waiting development requires not only large enough in terms of scale but also ensures rapid promotion. There will be reasonable divergent phases. There must be a simultaneous integration between the national S&T capacity building activities and the promotion activities for such capacities;
- In addition, not being followed the pathway of S&T application development (to make a difference), countries are often too inclined to develop basic sciences and disregard the development of applied sciences.

Success in developing national S&T capacities requires not only investment determination but also wise usages of the investment[4]. It has often been concluded that the yields and returns on S&T investments in developing countries are generally lower than in developed countries, with the same funding being spent. Investment in building and promoting national S&T capacities in the catching-up development must eliminate this situation. Only then, developing countries have the competitive advantage over the developed countries in S&T-based development.

In fact, these countries have formed and implemented mixed programs between science-technology-economic development, which are not also to develop national S&T capacities but also to embrace new development directions in the world. There are programs such as: Program 973, Program 863 and China Torch Program; Highly Advanced National Project (HAN), Biotech Program 2000, Korea Information Technology 839 Strategy (IT839 Strategy)... For example, the strategic objectives of the South Korea Biotech Program 2000 are: (i) to bring up Korean S&T capability in the field of

[4] This was exactly what Rao C.N.R., the President of Jawaharlal Nehru Center for Advanced Science Research in Bangalore, stated on the investment in science and nanotechnology in India: "We try to use our investment wisely and do our best" (The Ethics and Politics of Nanotechnology, 7/2006).

biotechnology to the level of the world's leading countries; (ii) to accelerate the transfer of biotechnology research technology for commercial applications; to create new biotech corporations through the development of new biotechnology on a solid basis of conventional biotechnology; (iii) to speed up the public's consensus on building sustainable and environmentally friendly technology; to recognize the importance of biological resources and seek strategic supports to protect the biological diversity associated with R&D in biotechnology. This program consists of three phases: Phase 1 (1994-1997): to establish a scientific infrastructure for biotechnology, to deploy bioremediation technologies and to build capacities for R&D industrial biotechnology; Phase 2 (1998-2002): to broaden the S&T foundation for the deployment of new biotechnology; Phase 3 (2003-2007): to expand the world market for biotech products of Korea. Information Technology 839 Strategy aims at accelerating the development of new IT services in the future. Information Technology 839 Strategy aims at bringing Korea to the forefront; and new services will be promoted to encourage investment in network infrastructure, resulting in integrated impacts with tools and equipments, softwares and contents that are particularly competitive. South Korea expects to reach US$20,000 per capita after implementing the program.

Despite strong strides, the catching-up pathway of the countries is still on its way. Among the new generation of catching-up development, South Korea is further ahead than others. South Korea has achieved the results that are equal to the leading countries, not only in terms of economy but also S&T. Since 2000, in Technology Achievement Index (TAI), South Korea has been listed as a leader in innovation, technology diffusion and capacity building[5]). According to the RAND Corporation's National S&T Competitiveness ranking, Korea has also been ranked No.1 in the Scientifically Advanced Countries (SAC), which includes 22 countries with higher S&T competencies than international average[6].

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[5] There are four groups of countries: *(i) Leaders* with a TAI value higher than 0.5. - These countries take the lead in creation, dissemination of technology and capacity building; *(ii) Potential Leaders* with a TAI of 0.35 to 0.49 - Most of the countries in this group have invested heavily in human skills and widely but less creative dissemination of old technology; (*iii) Dynamic Adapters* with a TAI value of 0.20 to 0.34 - These countries are very active in using new technologies; *(iv) Marginalized countries* with a TAI of less than 0.20 - The diffusion of technology and skills development is slow in these countries.

[6] There are four groups: *(i) Scientifically Advanced Countries* (SACs) - The group of countries with S&T capacities above the international average; *(ii) Scientifically Proficient Countries* (SPCs) - The group of countries with S&T capacities that are higher than or equal to the national average, however the levels are inconsistent (some indicators may exceed international average while others are lower); *(iii) Scientifically Developing Countries (SDC*) - The group of countries with some features that excel in science and tend to actively invest in science, but overall scientific capacities of these countries are still lower than the international average; (*iv) Scientifically Lagging Countries (SLC)* - The group of countries with almost scientific performance indicators that are lower than the international average.

At the same time, the researchers emphasized that Korean's S&T has some remarkable features such as:

- Although Korea spends a large share of its GDP on R&D compared to most other countries, its R&D activities are concentrated on a small number of large enterprises, causing serious imbalances in the system. Moreover, R&D in the industry is heavily concentrated on a number of industries such as electronics. There has been a divergence of Korean industries with one side of the companies and sectors with technology development and another stagnant side;
- Despite reaching advanced countries in terms of S&T inputs, South Korea is still inferior in terms of R&D efficiency. One of the reasons is related to the lack of interaction and exchange between key innovation organizations: universities, research institutes and manufacturing sectors;
- Basic science has not developed strongly: South Korea focuses on developing industrial technology, while scientific research is not paid much attention.

These are often considered to be constraints that raise doubts about how South Korea's development should be tackled to continue growing and sustainably developing. However, the problem can be seen at another angle. Achieving high economic achievement with a low level of S&T is an advantage rather than a limitation. Implementing the catching-up development on the basis of anticipation of technology in the current context requires certain adjustments in S&T capacities for development. The nature of the breakthrough and front waiting allows and requires acceptance on certain states that are considered incomplete from the traditional point of view. The advantage of catching-up developed countries is to create the overall effect (relationship between S&T and the economy) in the dynamics, rather than the comparison of inputs and outputs of S&T systems.

Comparing to South Korea, other countries like China, India, Singapore, etc. are still far from reaching the point that equals to those of top countries. This inferiority can be attributed by these following causes:

- The process of undertaking new major leaps through initial phase, which is ongoing and unfinished (for example, some of the high-tech development programs of countries extended to 2020);
- The catching-up development is limited to a few areas and sectors and is not enough to change the overall overview of the economy;
- A high level of success in taking advantage of the available opportunities for development has not been reached due to the limitation in future vision or the level of preparedness to catch up emerging opportunities.

For each of these causes, there must be a suitable solution. Especially in the last cause, the next step in the "catching-up" goal is not to measure by the extended period of time in which the development orientations have become out-of-dated or to gradually build up the overall capacity; but it is upon to new development opportunities to take place and on how those opportunities identified, and on the in-time preparation of national capabilities to turn common opportunities into their own advantages. Thus, the results achieved recently are not necessarily a fulcrum for development. The catching-up development through anticipation is fraught with risks and challenges.

4. Some notable differences

There have been some arguments on the opportunities for the developing countries to catch up with developed countries in new conditions. In the Third Wave, Alvin Toffler points out the advantages of developing countries when going straight forward to the advanced, modern world. The civilization of the Third Wave has many of same properties in society as those of the First Wave; it may be said to be a dialectical return. According to him, the surprising match between the many structural properties of civilizations of the First Wave and the Third Wave show that it is possible to combine the elements of the past and the future to create a new better present in the coming period. The third wave raises the possibility that poor countries can bypass small-scale industries of the First Wave or large-scale and concentrated industries of the Second Wave in order to focus on one of the key industries of the Third Wave…

Some neoclassical economists affirm that, in the long run, all countries will have the same income per capita. The neoclassical model explains social production, growth, and the difference between industrialized and developing countries by focusing on the "fundamental factors" which include: resources, technology and priorities. If the priorities of the countries are the same, the gap in capital resources between countries can only be explained as that: a country has begun the process of capital accumulation earlier than other countries. That is, underdevelopment is a consequence of slow starts. In the long run, all countries will have the same income per capita.

It is also related to the convergence hypothesis - which is an economist's hypothesis of growth rate, that is, there is a single dynamic equilibrium; and whatever level of capital per capita the economy starts with, it will all converge on that single dynamic equilibrium. Poor countries with low levels of capital per capita will grow faster until they achieve growth rates of output and capital at equilibrium. Rich countries inheriting the high level of capital per capita will grow slower until capital per capita is reduced to the dynamic equilibrium.

In these arguments, the subjective endeavors of later countries are often underscored. With the tendency to bring advantages for later countries, it seems that objective context plays the decisive role. This differs from the catching-up model (catching-up based on the differences), which requires a great deal of effort from the later countries. Catching-up development has been and will remain very rare. This statement may be true that: "Our perception of development has changed dramatically in the last 50 years. We understand that development is possible, not necessarily inevitable. We have had quite a few trials. However, there is no fixed formula for successful development. If we had it, we would have gained more. There are some strategies that work for a while, and then are no longer relevant; there are some successful strategies in one country which fail in another country..." *(Karla Hoff, Joseph E. Stiglitz, 2003, p. 114).*

It is also important to distinguish between the opportunities for catching-up development and those opportunities for normal development (including the development, which is higher than the previous periods of a country and the development with higher growth rates than those of the leading countries which shortens the lagging gap). There are opportunities for normal development such as:

- The trend of accelerating integration in the world creates conditions for developing countries to access and take advantage of the achievements of industrialized countries;
- In order to reduce R&D spending, high-tech companies around the world have focused on expanding their operations, establishing S&T organizations in developing countries and exploiting S&T resources in these countries[7];
- Advances in communications enable developing countries to have the opportunity to advance new technologies, bypass intermediate stages such as the use of copper telephone wires and similar telephones. Developing countries have an advantage over an industrial country, where half or more half of a telephone network continues to rely on older, more expensive and lower quality technologies. There are many opportunities for developing countries to grasp the advantages of information technology and communication in the dissemination of knowledge. Wireless technology requires less fixed investment than traditional wired technology, which is less expensive in countries with scattered populations, difficult terrain, and extreme climatic conditions as they require less maintenance.

[7] This differs from the view that: The yields and returns on investment in S&T in developing countries are often lower than those of developed countries, with the same funding being spent.

With the above opportunities, only modest development level can be achieved. It is impossible to obtain catching-up development with these small advances. These are the qualitative differences of development.

In fact, up until now, the development of history has been explored by the leading countries and usually follows the following main directions (which may be related but also be independent of each other):

(1) Once you have exploited the easy conditions, you have to move on to the harder ones. High level is compatible with more difficult conditions after having exploited easy conditions;

(2) Once the level of development has been reached at a certain level, there may be the resources and capacity available to carry out higher activities. Economies are not only producing immediate consumer products but also creating and accumulating conditions for production (capital, labor, infrastructure, tools (production areas for production materials), market, management). Through the creation and accumulation of these conditions, the economies have comparative advantages;

(3) On the basis of new insights, new ways could be found;

(4) New pressures must change (environment, social justice,...).

Directly related to the following countries, the nature and extent of impact of these above directions are different:

- Where (1) and (2) will not help the latter, the opposite will increase the gap;
- Where (3) and (4) may, on one hand, have an impact on the development of subsequent countries, contributing to the reduction of the gap; on another hand, they are to increase the gap.

In general, the development led by leading countries is affecting the latter countries, creating more disadvantages than favorable ones, increasing the risk of lagging behind, rather than the opportunities to shorten the lagging gap[8].

Moreover, between the states of development and stagnation, there is another state that is the risk of failure. This is the worst case. The nature of the risk that leads to a breakdown is a violation of the intent and ability, of the investment in advanced directions and the conditions under which those investments take effect... If the state of development is synchronous and full of advanced factors, and the state of stagnation has not got any advanced factors, the risk of breakdown occurs when there are some advanced factor but either asynchronous nor inconsistent,...

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[8] At present, some arguments have been claimed that globalization is creating new "gain" and "loss", new "winners" and "losers". For example, Paul Streeteen (Globalization: Threat or Salvation) has made the following comparison of globalization, in which globalization is claimed to induce adverse effects to many developing countries (as to some vulnerable groups of people such as the unqualified, the unskilled, the uneducated, the servant, the debtor, the dependents of public services, small companies, women and children, the weak,…).

The lag in development was noticeably early in Vietnam. From our obsession of lagging behind, we have developed in the direction of development with short-cut theories, shorten-up industrialization, industrialization in direction of modernization... These are the efforts in looking for directions to develop the country from many sides and many angles.

At the same time, the analysis of world experience in this article suggests that we still seemingly need to continue to study on the development way that overcomes the lagging gap. We need to be, in particular: more definitively in shaping the pathway of development (choosing between catching-up development and other forms of development); more fundamental in locating strategic, long-term directions; clearer to concretize the steps; more substantive in defining the role of S&T to prioritize and create consensus in society./.

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