GAPS IN THE RELATIONSHIP OF SCIENCE AND TECHNOLOGY WITH ECONOMY - A COMPARISON BETWEEN DEVELOPED AND DEVELOPING COUNTRIES

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Abstract:

The gap in the relationship of science and technology (S&T) with economy compared between developed and developing countries is determined by the level of S&T development in industrialization, technology generation, development wave, technological development level,… From these metrics, some basic characteristics of the gap can be clearly observed in many different aspects along the time, between developed and developing countries, among developing countries themselves, between the regions in a country in respect of the interaction and difference of the gap in the linkage between S&T with economy, scientific and technological gap, economic gap.

Gaps in the linkage of S&T with economy compared between developed and developing countries exists in a fairly sustainable way for many different reasons, such as internal limitation of developing countries, obstacles in dissemination of S&T achievements, intention of developed countries,…

Analysis of characteristics and causes of the gap in the relationship of S&T and economy compared between developed and developing countries is a meaningful study to provide basis for finding out solutions to reduce this gap.

Keywords: *Science and technology; Economy, Gap between science and technology and economy.*

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1. Expression of the distance in the relationship of S&T and economy between developed and developing countries

The interaction between S&T and economy is reflected in some outstanding linkages such as integration, interconnection and providing conditions to each other for development. In the context of development gap existed between developed and developing countries, this interrelationship has its own expression. It is possible to outline some aspects of the distance in the relationship of S&T and economy between developed and developing countries as a manifestation, on the one hand, and as a consequence, on the other, as follows:

(1) As per *level of scientific and technological development in industrialization*. Corresponding to the level of industrialization there are different levels of technology. Through these level we can see the difference between developed and developing countries:

- *Pre-industrialization*: traditional technologies (based on experience) were dominant;
- *Under industrialization*: imported technologies from abroad were of high attention;
- *Semi-industrialization*: imitation, improvement of imported technologies;
- *Newly industrialized countries (NIC)*: Combination of indigenous technologies with imported ones;
- *Leading industrialized countries*: development of basic research, applied research, experimental development to create new technologies.

(2) As *per technology generation*. The first technology generation was based on water and timber. The second one used steam-machines, coal and iron. The third one used manned transport, power machines, machine tools... The fourth generation used synchronized mechanical machine systems in manufacturing processes, combining power systems, machine tools, transport machines to operate at the same time and in the same space. The fifth technology generation was characterized by the extensive use of computer based technological systems. Technologies in the sixth generation now are the continuous technology innovation of the product life cycle based on the market situation.

While developed countries are using technologies of the fifth and sixth generation, in developing countries, most of manufacturing industries is still exploiting technologies of the second and third generation.

(3) *As per development wave.* Alvin Toffler proposed the theory of development wave. The first wave was of agriculture in the pre-industrial revolution. Coal mining, railway, textile, steel, automobile, rubber, machine tool were the classic industries of the second wave. The third wave was characterized by new industries with obvious difference to previous industries in many aspects: they were not the type of electric motor and not based on classic science era of the second wave. They were the combination of different sciences recently appeared over the past 25 years, namely: quantum electronics, informatics and molecular biology, oceanography, nuclear engineering, ecology and space science.

The difference between developed and developing countries is whether it of the third or the second wave.

(4) *As per level of technology development*. The level of S&T development can be classified as follows: Level 1 is the import of technology to satisfy minimum needs; Level 2 is the organization of minimum economic infrastructure to adapt imported technology; Level 3 is technology generation from foreign technology sources through assembling efforts (SKD, CKD, IKD); Level 4 is technology development via licensing; Level 5 is technology innovation through research and deployment; Level 6 is research and deployment-based technology export; Level 7 is continuous technology innovation based on high investment in basic research.

Developed countries now reach the level 5, 6, 7 while developing countries are of the first four levels.

(5) As per proportion of new knowledge embedded in technology, equipment and production organization. For developed countries, the balance between knowledge and resources has greatly inclined towards knowledge, knowledge has perhaps become the most important decisive factor in raising living standards - more than land, tools, labor. Developed countries are actually knowledge based countries. The proportion of new knowledge integrated into technology, equipment and organization of production of these countries makes up to 75-80% of GDP.

Developing countries have constraints in creating new knowledge, having qualified manpower to acquire and disseminate knowledge. The difference between developed and developing countries in introducing new knowledge into production is evident through the operation of businesses and in some new industries.

(6) *As per technological capacity.* Technological capability is classified into 4 levels. First level: high labor intensive, whereby technology is applied without much understanding; Second level: high skill intensive, where the application of technology requires high technical skills and efficient technology selection, technology application and savvy; Third level: Technological Intensive, where there need skills to design and improve products without changing their main characteristics; Fourth level: Research and development (R&D), where there is the capacity to conduct research and development on the main features of the existing products.

Developed countries now reach the third and fourth level, while developing countries generally are at the first and second level.

(7) *As per stage of competitive development*. There are three stages of competitive development, i.e: (i) *Factor-Driven Stage*, where fundamental conditions like low-cost labor and unprocessed natural

resources is the most dominant basis for competitive advantage and export; (ii) *Investment-Driven Stage*, where the advantage of a country stems from a highly efficient production of more advanced products and services; (iii) *Innovation-Driven Stage*, where exists the capacity to produce innovative products and services in the global technological framework, using the most advanced methods becomes the most dominant tool of competitive advantage. Developed countries are in stage 3 and developing countries fall into stage 1 and 2.

(8) As per compatible relationship between technology and market development. There exists an interconnection between technology development and market development. This interaction is also a measurement of the level of development and reflects the gap between developed and developing countries. There are 5 stages of market development, i.e: passive import; proactive sale of goods; sale of higher class products; accelerated product marketing; promotion of branded products. Different stages require different corresponding levels of technology.

Developed countries are mainly in the fourth and fifth development stage while developing countries, mainly are in stage one, stage two, only a few reach the third stage.

(9) As per number of S&T based businesses. There are a lot of assessments relating to S&T of enterprises and they may reflect the difference between developed and developing countries: only developed countries can have pioneer firms in respect of new technologies[1]; the ratio of innovative businesses in developed countries is higher than that in developing countries[2]; enterprise's R&D activities (number of enterprises conducting R&D and level of their investment for R&D) are more in developed countries than in developing countries.

(10) *As per Technology Achievement Index* (TAI). The value of TAI is classified into 4 groups of country: Leaders are those countries with value of TAI higher than 0.5; Potential Leaders are countries with TAI value from 0.35 to 0.49; Dynamic Adapters are countries with TAI

[1] World Economic Forum in Geneva stated that there were 36 companies chosen as "Technology Pioneers 2006". About half of these firms (17) were the companies based in U.S.A, including 12 firms in California. According to the Forum, the UK had 8 Technology Pioneers 2006, Germany had 3 firms, Israel 3 firms. Canada, France, Hungary, Iceland and Sweden had one each. Technology Pioneers firms were selected from the world's leading companies in technology and venture capital under three areas: energy, biotechnology/ health and information technology.

[2] For example, a comparison between the ratio of innovative businesses in Thailand and South Korea showed that there was 42.8% innovative companies in Korea, while only 11.2% in Thailand; 21.0% Korean companies had innovative products and production processes, while only 2.9% of firms did the same in Thailand;... (Thailand R&D and Innovation Survey 2002 and Korean Innovation Survey 2002).

value from 0.20 to 0.34; and Marginalized countries with TAI value lower than 0.20.

Developing countries now belong to the last two above groups.

(11) *As per contribution of S&T in economic development*. The contribution of S&T in economic development in developed countries is higher than that in developing countries. For example, the World Bank conducted an analysis in 38 countries and regions. It was shown that the contribution of technological progress to economic growth in developed countries was 50% and in developing countries was only 31% [4, p.52].

2. Basic characteristics of the gap in the relationship of S&T with economic development between developed and developing countries

The above aspects are the measurement to determine the gap in the linkage of S&T with economic development between developed and developing countries; and at the same time it shows some basic characteristics of this distance.

2.1. The gap in the relationship of S&T with economic development between developed and developing countries is expressed at different levels along the time

The expression of the gap in the relationship of S&T with economic development between developed and developing countries is expressed at different levels along the time. It is certainly the milestones on the path of forward looking development and reflects different growth rates. As Alvin Toffler ever commented: *"Human beings on the Earth are divided not only by race, nation, religion or ideology, but also by position in their time"* [12, p.23].

This reflection is most evident in the assessment as per level of S&T development in industrialization (1st way of assessment), as per technology generation (2nd way of assessment), as per wave of development (3rd way of assessment), or as per level of contribution of knowledge to economic development (5th way of assessment).

The difference here could be understood as how the development steps take place (ahead and lag behind countries in development process) and at what speed (fast and slow growth in development process). The world has simultaneously witnessed many different steps and different rates of development in the relationship between S&T and economy. In the process of development, developed countries take breakthrough, pioneered and fast-forward steps while developing countries are lag behind and slower in speed.

It is obvious that gap in space is often more complicated than gap occurs along the time. Development level is not stand still, level of the past cannot exist in the new era. One can find intertwined phenomena of old and new, backward and advanced things in the countries being considered most developed. Thus, the compatibility between difference in space and stage of historical development is only in general and basic terms.

Close relationship between development by time and by space is not only reflected in the use of development history level as a basis for analyzing the gap between countries, regions, but also placed in a dynamic development context. History of development of the relationship between S&T and economy shall change the distance of this linkage in terms of space. Looking at development stages in history, it is observed that the present stage is not even, in the following aspects:

- Uneven steps in history of development;
- Uneven in efforts to shorten the distance to the historical peak achieved;
- Uneven in seize the opportunity in that the history open for development.

The increasingly larger gap in the relationship of S&T and economy between the advanced and lag behind countries can be explained.

History took out big steps, namely the agricultural revolution, two industrial revolutions and the ongoing scientific and technological revolution. In the first three revolutions, S&T played an important role in economic development[3]. However, S&T and the relationship between S&T and economy were still behind factors, not as outstanding as the change element in economic sectors. Until the fourth revolution, S&T become more central and more influencing. S&T in this revolution played crucial roles. S&T and economy were much closely linked than ever before. Together with that, the gap in the linkage of S&T and economy between countries realizing S&T revolution and other countries has also been expanding.

2.2. The gap in the relationship of S&T and economy between developed and developing countries is expressed in/on many different aspects/sides

The gap in the relationship of S&T and economy between developed and developing countries is expressed in/on many different aspects/sides.

[3] For instance, in the first Industrial Revolution, the British took advantage of application of scientific inventions of the whole Europe for their economic development. In the second Industrial Revolution, one of the bases for German Empire to replace Great Britain to become the leading nation of Europe in the field of industry, Germany made greater investment in scientific research than Great Britain. In United States, the second industrial revolution was often associated with the electrification of the pioneer inventors, namely Nikola Tesla, Thomas Alva Edison and George Westinghouse and management by science philosophy applied by Frederick Winslow Taylor.

Moreover, the mentioned sides/ aspects cannot only be captured, but also exposed their clear meaning in practice.

Assessments can be made through comparison of quantitative/qualitative relationship, in respect of interaction/ supplementary tool of each other component, single/aggregate component as the shown in the table below.

Table 1. Comparative assessment on the gap in S&T and economy relationship between developed and developing countries

Method of assessment (*)	Qualitative / Quantitative		Supplementary/Tool of each other		Single/aggregate	
	Qualitative	Quantitative	Supplementary to each other	Tool of each other	Single	Aggregate
(1)	X		X			X
(2)	X			X		X
(3)	X		X			X
(4)	X			X		X
(5)		X		X		X
(6)	X		X			X
(7)	X			X		X
(8)	X			X		X
(9)		X	X			X
(10)		X	X			X
(11)		X	X			X

(*) Following the procedure set out in Section 1.

Thus, because of the complicated phenomenon of the gap as mentioned here, there should be additional, mutual support between different ways of assessment. Nevertheless, it is possible and necessary to choose a particular approach to be appropriate with each specific research objective.

2.3. Common point on the gap in the relationship of S&T and economy at different levels

There are common measurements used for the assessment of the gap in the relationship between S&T and economy at different levels (between developed and developing countries; between developing countries themselves; between regions in a country). Typically, there are some methods of assessment as follows: by technology generation (2^{nd} assessment); by level of development of different technologies (4^{th}

assessment); by technological capability (6th assessment), by stage of competitive development (7th assessment); by TAI index (10th assessment)[4].

This shows a certain similarity between the gap of developed and developing countries with the internal gap within developed countries, internal gap within developing countries... To larger extent, common measurement is significant to suggest the possibility of shortening and eliminating the gap in some specific cases.

On the other hand, the common measurement also expose the particularity of the gap in the relationship of S&T and economy between developed and developing countries (compared to other types of gap) with respect to the distension between "change in amount within the old substantive scope" and “change in amount leads to change in substance”.

In TAI index, though the "Dynamic Adapters" group of countries had more progress than the "marginalized” group, they still remained in the rank of slow and incomplete application of technological progress. The fundamental difference between the upper developed countries (Group of Dynamic Adapters) and the lower developed countries (Potential Leaders) is reflected in the technological innovation capacity and the broad and quick level of technology dissemination.

2.4. Similarity and difference of the gap in the relationship of S&T with economy and the scientific and technological gap, economic gap

Interactive relation between the gap in the relationship of S&T with economy and the economic gap was clearly expressed in the evaluation by level of scientific and technological development in industrialization (1st way of assessment); by development wave (3rd way of assessment); by consistency between technology development and market development (8th way of assessment); by S&T based businesses (9th way of assessment); by contribution of S&T in economic development (11th way of assessment).

The interactive relation between the gap in the relationship of S&T with economy and the S&T gap was clearly expressed in the evaluation by technology generation (2nd way of assessment); by different level of technology development (4th way of assessment), by technological capability (6th way of assessment); and by TAI index (10th way of assessment).

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[4] Taking example of TAI index. This index allows us to identify the hierarchy of all countries evaluated, and analyze internally both developed and developing countries. Internally, developed countries are classified into various groups, such as "Leaders" and "Potential Leaders”. Developing countries are also internally classified into two groups, such as "Dynamic Adapters" and "Marginalized”.

In the field of S&T and in economic field, there exist specific criteria of their own for assessment of the gap between developed and developing countries (independent from assessment of the gap in the relationship between S&T and economy). For example, for assessment of S&T gap, there are some major criteria such as: total expenditure for R&D per capita; total expenditure for R&D/GDP; expenses of enterprise for R&D; expenses of enterprise on R&D per capita; total national R&D manpower per 1,000 people, total R&D personnel in enterprise per 1,000 people, number of scientific papers published; Nobel Prizes obtained based on number of population; number of patents granted by RAND[5] Corporation's assessment. With respect to economic gap (broadly speaking), the criteria maybe: GDP per capita; export value per capita; Knowledge Economy Index (KEI). This shows the difference between the gap assessment of the relationship of S&T and economy and the scientific and technological gap, economic gap.

When comparing the gap level (developed and developing countries) between S&T, production, and the relationship of S&T and economy, it may see a certain correlation. At the same time, the level of scientific and technological, production gap and the level of gap in the relation of S&T and economy are not substantially equal. Research by World Bank placed the emphasis on the difference between rich and poor countries, by some important indicators, in knowledge creation is even greater than the difference in income…

If the scientific and technological gap between developed and developing countries is greater than the economic gap, so the gap in the relationship of S&T and economy is also greater than the economic gap.

3. Causes of the gap in the relationship of S&T and economy between developed and developing countries

The gap existed in the relationship of S&T with economy between developed and developing countries seems fairly stable. Efforts to narrow the gap are facing many obstacles and what considered a success is still modest. The following will explore some fundamental causes of this phenomenon.

3.1. Internal causes of developing countries

3.1.1. Limited capacity

[5] RAND Corporation, in their report, they ranked countries in the world into 4 groups according to different scientific capacities, in the process of relationship of S&T international cooperation.

a) In terms of scientific research capability

Differences in scientific research capacity are of both an expression and a cause of the gap in the relationship of S&T and economy among countries. Science plays an important role in creating technologies, promoting industrialization and modernization.

Right from the beginning of the industrial revolution, it was impossible for strong development of relationship of S&T and economy to take place without the presence of science. Historians firmly acknowledged that the development of science in the post-medieval period was an important premise for British technological inventions in XVIII - XIX centuries. It could be said that, the high development of Europe and England in XVIII century was thanks to science. With science it was formed a kind of "European" S&T that other places like China could not develop. Although the actual effect on application of scientific and technological achievements in China was previously much greater than in Europe, the situation changed dramatically in the new revolution: science-based technology.

In this context, the lack of scientific capacity it cannot make scientific and technological development happen, therefore it always is lag behind in the relation of S&T with economy.

The significance of Science is also expressed in terms of technology application, technology transfer from abroad. Science affects the application, master of technologies imported from outside. One of the knowhow of Japan's success was the sound combination of domestic research and development activities with the import of foreign technologies, especially from US in order to master, adapt and improve the imported technologies for their economic development and then export improved technologies abroad, including to countries having created those technologies.

It should also be worth to note that research and development capacity is very important in seizing S&T power. That is the distinction between "qualification" and "intensity" as per words of Alvin Toffler mentioned in "Up and Down Power" 10 years ago, UNDP once made the comment: "Although over 20 years it witnessed a significant and excellent development in research activities in a number of developed countries, many other countries still have not appropriate research and development capacity. Lack of that capacity the country cannot adapt global technologies for their needs, nor set up programs for their own research to create new inventions" [3, p.112-113].

b) With respect to Application Capacity

The application needs a certain capacity. When looking at these capacities it can find some major restrictions of developing countries compared with developed ones.

Developing countries cannot simply import technology and apply knowledge from outside by having different types of equipment, seeds and medicine. Not all countries need to develop spearhead technology, but any country needs to have in place the capacity to recognize potential benefits of the technology and adapt new technologies to meet requirements of the country. Especially in the current period, the strong development of S&T and the world economic fluctuation are placing challenges to developing countries when approaching new technologies.

With a view to applying technology in an effective manner to catch-up preceding countries, lag behind countries should not only need knowledge but also the critic capacity. That is the difference between technology application and the use of normal items. It can make a comparison: "Consumption (theories) first means "digestion", the same as for bees. But, it also has other meaning: It is the consumption of theories of others or of his/her own, this means to be able to criticize, modify and sometimes even break, replace them with those better theories" [14].

c) Concerning fundamental elements to develop the relationship of S&T and economy

Limitations of developing countries in capital and human resources, institutional capacity and infrastructure are one of the reasons causing the gap in the relationship of S&T and economy between developed and developing countries.

In terms of capital, for instance, the impact of investment in relation of S&T and economy is very high, long-term and very risky. These are difficulties of countries with low economic level. If the economy is poor, despite spending a high proportion of GDP, the budget in absolute number for R&D is insignificant. Due to limited financial resources, it makes developing countries often difficult to secure enough money to pay for the reception of scientific and technological knowledge and other fees, not to mention about investment for their own research and development.

To apply scientific and technological achievements into production it needs to undertake a lot of changes with corresponding costs. For example, when computers were first used in the office, everyone expected a sharp rise in productivity. But that did not happen immediately and lead to a mix of depression and confusion. In a book "Computers and generators: paradox in

modern productivity- a not too far reflection", Economic Historian Paul A. David explained that delay by pointing out precedent stories in history. He noted that although electric light bulb was invented in 1879 but it took several decades for electrification to develop and make a strong influence on the economy and productivity. The reason was that only with electric motors installed and old technology of steam engine discarded was not enough. There must be an uniform combination of related infrastructure, personnel training, equipment replacement, etc ...That is really a huge and extensive investment.

3.1.2. Obstacles in creating enabling environment to promote linkage of S&T with economy

It is obvious that there are many obstacles in creating enabling environment to promote linkage of S&T with economy in the following aspects: economic environment to promote new technologies, education environment, environment to promote S&T in society.

For S&T to be applied and make full wings in reality there should be sound economic environment to consume new technology based products and good coordination among economic sectors utilizing advanced technologies,… These are the conditions that lag behind countries still missing. Currently, R&D activities are very much associated with the production development, however, production in developing countries often does not create as necessary conditions for S&T activities as industrialized developed countries.

In developing countries, there is a growing gap between the achievements obtained from scientific and technological progress and the practical application of such results. This was explained by Eimandjra that it was due to the lack of necessary efforts in education, which could facilitate the dissemination of the achievement of technical progress [11, p.10].

Awareness of society on S&T has major influence on the linkage of S&T and economy. Many public opinions in U.S., UK, Japan demonstrated that the majority of people had trust in scientists, believed that scientific results achieved were of great value and strong enough to justify possible losses which may occur. In U.S., science has been ranked No. 2 in recent decades, obtained "high level of reliability" in the assessment scale of the society.

In developing countries, social awareness of S&T is still low and lag behind compared with developed countries. Even in China, by 2010, the level of scientific understanding of Chinese people was equivalent to the level of developed countries by the end of 1980's. In the Philippines, the S&T

Vision 2020 also emphasizes that: "For many Filipinos, S&T is still an unfamiliar or mysterious topic, it is not an important part in their daily activities or their existence",...

3.2. External causes

3.2.1. Obstacles in widespread dissemination of knowledge

There was a comment saying that *"Knowledge is like light. It has no weight and is intangible, it can easily travel around the world, make live of people illuminated everywhere"* [2, p.13]. According to several authors, the widespread dissemination of knowledge, scientific and technological results seem to take place quite clearly in the present history of development. In his book "Up and down of power", Alvin Toffler emphasized that out of the three dimensions of power (violence, wealth, knowledge), knowledge seems more democratic; at the same time there witnessed a change in power in the direction of moving to widely disseminating knowledge. In *"A Flat World - brief history of the world in 21st century"*, Thomas L. Friedman expressed his views on the flattening process of the world which is happening with different speeds and affecting immediately, whether directly or indirectly to many people on the planet.

However, the widespread dissemination of scientific and technological results is, in reality, associated with production and still meets significant obstacles.

First of all, technology is not a free lunch, it is for sale at quite high prices that may be unaffordable by economies of developing countries[6]. At the same time, the acquisition of knowledge is not an easy task, not just to pay and take like buying bread or computers, it requires sufficient capacity to recognize and seize the know-hows of the technology.

Also, there is a difference between S&T information, S&T knowledge and the ability to master knowledge in production.

3.2.2 Obstacles due to local objective oriented S&T

Science is a common property. On the one hand, scientific products can be commonly used (without being affected), and on the other hand, it is a product of common efforts. This has been confirmed quite clearly: *"Scientific work is a common effort of the mankind made, on one side, by the cooperation of contemporary human beings and on the other side, by using*

[6] It is right with the comment: "The South poorest countries are hardly affordable to pay for the acquisition of S&T knowledge and for other costs involved" [13, p. 346].

the effort made by the predecessors" (Karl Heinrich Marx)," Science is a best example of collective work done by people of all ages from all countries" (R. Taton. (1955) Causalités et accidents de la descouverte scientifique. Paris, 1955, p.149), *"Knowledge based knowledge, and all new things are worthy because they were derived slightly from what people have known"* (J.R.Oppenheimer (1959) Science and Common Understanding. N.Y, p.96). It is not obvious to have the saying: "Art is mine, Science is ours".

So why common things can turn into private ones? That is the impact of economy: economic context of economic determines whether S&T is of common or private character.

More correctly, the significance of S&T includes 3 different aspects: common academic significance to the mankind; common technical-economic significance for a certain era; economic significance for a particular interest group. R. Le Guen had reason when expressing an opinion against the formula "intellectual revolution" by proposing the new one "revolution through intelligence". According to him, the meaning of human activity is the use of knowledge as a means. Arguing with supporters for his opposition formula, Le Guen noted that those people in view of the "intellectual revolution" seemed to think in the revolution itself there was enough capacity to ensure positive changes in human and society; and some others believed that the revolution is obvious and people had to adapt with it (Le Guen R. (1989) Dimentions scientifiques et technologiques de la culture. "Pensée", N.272, p.29-30). Maybe we should rely on the distinction between economic activity through S&T (S&T is used as a tool) and S&T is the foundation of economic activity.

Internal relation of S&T and economy is subject to be governed by market mechanism, in this context, market mechanism even have much stronger working conditions than in other economic relations. The impact of the market to technology is very strong. Normally, global markets are drawing a technological trajectory which is not appropriate to the need of developing countries. Research programs are driven by the interest of scientists and inventors in research centers, and promoted by the needs and desires of high income consumers in Europe, Japan, North America.

Technology is created by the market pressure - not for satisfying the need of the poor having low purchasing power. R&D, human and finance resources are concentrated in rich countries, controlled by global groups and the global market need is influenced by better-off people.

Driven by market mechanism, the application of S&T is directed to profit making targets and ignore other concerns[7]. The current system is for some rich countries, not for the mass. There is a certain difference between the problems of rich and poor countries. This difference brings about differences in the interest of the world's S&T (which is dominated by rich countries)[8]. Some outstanding features are:

- *Demand issue*. Technology is created to satisfy the need of consumers and producers in developed countries, not necessarily to address the need in developing countries.
- *Application condition issue*. Created technology is to be applied in certain conditions (available economic resources, economic and S&T infrastructure, social conditions,...). Developed economies are not easily adaptive with the conditions of developing economies.
- *Population issue*. This issue is of not much interest. New technologies of developed countries have no impact on the population explosion in developing countries, they may even make harm to the poor by making some economic activities become redundant.
- *Unreasonable price*. Global markets should make global pricing. In reality, technology goods have relatively high price compared to the affordability of poor countries. In fact, there have been some incentives proposed for poor countries but they have not been implemented. For example, "Build a multi-level tariff. That means from pharmaceuticals to computer software, important technology products are now in the world demand. An effective global market would encourage setting different prices of these products in different countries, but the current system is not promoted" [3, p.9]. These initiatives encounter difficulties due to difficult consensus on how global market to be segmented so that essential technology products can be sold at low prices in developing countries.

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[7] As some reflections made: "The absence of unanimous agreement on the objectives of science and technology at global level is what abetting the use of science and technology for improved production and high profit making, not for the purpose of combating against poverty, social injustice, destruction and devastation of natural resources, neither for fighting for human dignity and human rights" (Eimandjra M. (1989) Fusion de la science et de la culture: Lade du 21 scièle. "Pensée".N.272, p.13); "Looking for profit has spurred technology innovation at least since the industrial revolution. But, just as the intentional creation of textile factories, engined machines, steel mills and railway has brought about significant results more than unexpected by people in the country and abroad, some technologies appear today can also bring profound consequences for contemporary society, particularly in the developing world. Thus, before the threshold of the twenty-first century, the earth seems to realize that their life will be more hurt because of irresponsible forces, in full sense of the word" [13, p.89].

[8] Technological advances are often developed in rich countries, as main sources of technology (over 90% of the world expenditure for R&D was effected in OECD countries), the application of prevalent conditions of these countries may not be appropriate for least developed countries (LDC).

3.3. Subjective causes of developed countries

It can confirm that, because of their benefits, advanced countries are interested in reducing the gap in the world. Gap in development level can provide benefits but on the other side, it can make difficulties for them, for instance, hard to sell products (purchasing power of developing countries low); difficult to find places for investment (investment to outside also needs a certain capacity); difficult economic transition to a higher level (to move up to higher level, advanced countries need to reallocate the current economic level to other places, the unstability caused by poverty. Therefore, advanced countries also want to help developing countries to develop. In addition, the assistance also has some purposes such as showing their kindness to realize other targets,...

However, it is only a small scope. In general, the problems that developing countries caused to developed countries are still significant. Preventing technology transfer to other countries to avoid future competition has long been received high attention. For example, in 1510, Maraluo, island lords (Italy) tried to find the way to keep tin-mercury plated mirror technology invented by Darcaro brothers to fall into the hands of outsiders. When U.S. conducted the industrial revolution beginning with textile industry (particularly in cotton cloth industry), the import of technology from UK became an important significance. The British government recognized that and prevented this by promulgating in 1765, 1774 various laws to prohibit the migration of skilled workers to the United States, ban the export of technical drawings and textile machinery...

Korean import of technology fell sharply in late 1980s, partly because of the international technology competition trend and technology protectionism were strong in U.S., Japan and European Union (EU). In Thailand, foreign firms had also limited expansion of sub-contracts or technical assistance to local suppliers...

The intention of keeping technical know-how in countries with advanced S&T is increasingly clear. The provision of technology from developed countries to developing countries becomes more and more difficult and less objective.

Limited transfer of technology from one country to another in general and from developed to developing countries in particular, is due to the fact that technology is considered as an important competitive weapon. From the purpose of meeting specific needs of human beings, technology is increasingly being used as a means to achieve competitive advantage in the marketplace.

Although technology has become a commercial goods, it also has the ability to make the international competitive market different. Developing

countries mainly export crude items (agro-products and industrial raw materials with low technological content) to developed countries, while they import most manufactured products (including tools, and machines with high technological content) from developed countries. This is a great advantage that developed countries want to maintain the value of their products by a higher value added while the price of raw products is very unstable and tends to decrease.

As a competitive weapon, technology becomes an object of conditional exchange. There was a view that technology was traded between developed and developing world not as a commodity but as a modality of land lease under feudal times; for developing countries, technology is only considered as a lease, not for sale. Some researchers say that the conventional international exchange tends to move to "technology for technology" much more than "technology for money exchange" modality.

Technology becomes a new form of currency used in international market. Advanced industrialized countries hold natural advantages. In contrast, countries not having endogenous technological capacity will be in disadvantage in technology exchange. Some politicians clearly understand the crucial role of technology mastering in international economic war. Typically is the statement of Henry Kissinger, i.e: "The period 1950 - 1960, when United States ruled the world by financial and military interventions was over. The means which help us to act from now is the capacity of our technology" [10]. Scholars also had comment: "Assuming that there is mutual benefit (positive-sum), cooperation in the field of S&T has become more complicated by the fact that the development and application of new knowledge in trade and national security is often accompanied with competition pressures and likely leads to end winners and losers (zero-sum)" [5, p.1-2].

An in-depth study to find out causes shall provide solutions to overcome obstacles. With the above presentation, the gap between developed and developing countries in relation to the linkage of S&T and economy derived from some quite basic, deep causes made by many different sides. Correspondently, to overcome what is often regarded as destiny, developing countries must make continuous comprehensive efforts, and take advantage of opportunities from outside./.

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