South Korean Transitional Periods from Imitation to Innovation

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The technology transfer and development model of South Korea is unique. After other countries refused to license and transfer modern technologies to this country, Korea resorted to its national research system to add innovative content to its imitative products.

Keywords: innovation ; imitation ; national innovation system

1. Pre-Transitional Period in Korea: Pre Innovation Era

In the first period before 1961, Korea was under Japanese occupation, followed by US influence and civil war for 50 years that continued even after independence in 1953 during the era of the First Republic headed by Syngman Rhee (1948–1960) [1]. From 1960 to 1962, four presidents were overthrown, ending with the military coup on 24 March 1962, led by Park Chung-hee, who started what was known as the Third Korean Republic and ruled the country for nearly 17 years until his assassination in 1979 [2]. The precursors of the transition to imitation coincided with the rule of Park Chung-hee. The 2 years preceding his rule witnessed severe political fluctuations under four presidents. Knowing the style and methodology of the country's political leadership may lead us to identify the source of legislation, strategic directions, and visions for the nation. The transition to innovation (as observed in other countries) stems from the legislative authority of the nation, accompanied by the interdependence and overlap of the nation's institutions, the response of its society, and the country's relations with innovative nations and ideas of how to adopt the simulation and copying methodology of foreign innovations in the early periods. Accordingly, political authority is the source of legislation and the steering wheel of transformation into an innovative nation.

An analysis of the period before 1961 shows that Korea did not possess modern technologies or advanced industries and could not even simulate or copy any innovations that reached its ports except for what had been established by the Japanese government during its colonization of Korea after the 1910 Japan–Korea Annexation Treaty, which placed Korea under Japan's protectorate. Companies and factories in Korea under occupation were established in the Japanese style. In previous studies, the researchers explained how Japan became an innovative country in the modern era. Japan transferred some industries to Korea, especially the railway industry, the banking industry, and the holding company system. Japan began building a railway linking the Chun Zechon Port to the Korean capital between 1900–1910 to pave the way for a quick outlet for military forces after landing in the port, as became clear after the occupation. This was to repel any attack or expansion of China in the region [3][4][5].

The precursors of occupation were the movement of foreign investments to Korea, intensification of these interests, and then demands to protect them, ensure their safety, and enhance their success. Just as foreign investments sometimes contribute to the renaissance and growth of countries, they may be a reason to invade them and a pretext for occupying and placing them under protection.

2. First Transitional Period in South Korea: Import Substitution Policy

With the beginning of the second period (copying and imitation) in 1961, South Korea implemented the "Import Substitution Policy" by enacting laws and establishing incentive programs that encouraged the industrialization of everything imported, and setting up disincentive programs to reduce imports. A series of restrictions on imported products was initiated in favor of domestic manufacture of a particular product. In order for South Korea to reach this stage in the local industry, it resorted to two measures, namely foreign technological licenses and foreign technological consultation. Through technological licenses, South Korean factories transferred technology to copy, simulate, and imitate the imported foreign products, and through foreign technological consultations, it could train, teach, and maintain and repair the devices and equipment imported for local manufacturing, which were basically copies and imitations of what was imported, but

with licenses from the technology owners. At this stage, South Korea needed to build workforce capacity in technological and engineering fields. The process of importing technology required a minimum level of technological capabilities of the local workforce to benefit from the imported technology. Without this, countries cannot even begin copying and imitation, a process that requires skills and infrastructure that are not easy to prepare and qualify. Training and qualification of the local workforce was key to dealing with and operating imported technologies. Re-manufacturing imported products within the country requires support from the country's government, along with protection by discouraging and restricting the import of products so that the national entities can compete in the beginning [6][7][8].

The South Korean government subsidized the domestic private sector. Foreign companies and branches of international companies move around the world looking for better markets or lower wages, and they are never a reliable source for generating sustainable growth for specific countries. The state's investment was directed towards developing capabilities in the national private sector.

In 1962–1983, the South Korean government imposed strict restrictions on foreign direct capital entry into the country to reduce and regulate foreign influence and ensure the development of industry and national investment in national capital, especially in the early stages. Some restrictions were later relaxed gradually in 1984–1994, and the activities and projects in which foreign direct capital was prohibited decreased to only 147 projects compared with the previous period. South Korea then began to stimulate foreign direct capital in some fields, starting in 1995. FDI increased from USD 1.36 billion in 1995 to USD 11 billion in 1999, an increase of nearly ninefold in just 4 years after the policy concerning foreign investment changed [6].

The benefits of these restrictions on foreign investments are evident today. They protected the nascent national industries and investments. They were followed by gradual easing in each industrial sector and activity according to the ability of the local industry to grow in terms of simulation, imitation, and copying. The efforts also focused on turn-key factories that did not specialize in producing a specific industry but were used in several industries to keep pace with supply and demand and the transformation of economic activities, especially during the first period of economic growth.

3. Second Transitional Period in South Korea: Export Promotion Policy

As an intermediate stage of progress in industrial growth and economic prosperity, South Korea shifted from the "import substitution" policy to the "export promotion" policy in the 1970s. There was a shift in first production volume and then production quality. The goal in the first stage (import substitution) was to create a local industry that was capable of substituting the imported goods. The South Korean government's direct support accompanied this endeavor on the one hand, along with restrictions on imported products in favor of national products, which were imitations and of poor quality compared with the imported foreign products. However, this created a local economy capable of covering the basic industrial needs and correcting the trade balance between South Korea and foreign exporting countries, which was depleting hard currency to bring foreign products into the country [9][10].

The goal of the "export promotion" phase (an advanced stage of copying, imitation, and simulation) was to bring in foreign currency from abroad and correct the trade balance in favor of South Korea. However, this phase was not easy, as the South Korean products in 1970–1980 were imitations of poor quality compared with products in developed countries. South Korea's gamble relied on two factors, namely the low-waged Korean labor, which made the cost of the product lower by a profitable difference, allowing it to reach the markets of other foreign countries. Furthermore, the government generously supported the local industries through programs, regulations, and legislation that enabled the local exporting producers (investors) to receive benefits, financing, grants, subsidies, and tax exemptions.

In addition to the low-quality and low-cost South Korean exports in 1960–1980 due to low-waged labor as one of the production inputs, South Korean exports were known in general as low-tech commodities, such as shoes and textiles, which depended largely on low-cost labor. Thus, consumers had the impression that South Korean products were mere imitations, or from simple and uncomplicated industries. The South Korean government began to shift its focus to exports with a higher technological content (or higher added value). In 1960, exports constituted only 2% of GDP. This percentage rose to 10% in 1970 and then 30% in 1980. However, 30% of these exports were shoes and textiles, which were simple and uncomplicated industries. However, the South Korean government's contribution to programs to transform export quality increased the added value in export quality. Accordingly, the percentage of textiles and shoes decreased from 30% in 1960 to 10% in 1990 and then to less than 3% in 2000. As mentioned at the beginning of this chapter, the revenue from total South Korean exports rose from USD 2 billion in 1960 to USD 557 billion in 1996 [9], an indication of the change in the quality of South Korean industries during the 40 years between 1960 and 2000.

4. Third Transitional Period in South Korea: Building National Research and Innovation Systems

However, in the early 1980s, South Korea received a technological shock because its industries and exports were based on imitation, simulation, and copying. In other words, if the licensing companies stopped their licenses, South Korean companies would not be able to modernize their production lines and introduce developed industries. The technology-licensing countries, such as Japan, the USA, and European nations, sensed that the South Korean industry could be competitive due to low prices and the similar quality of the imitative product (in advanced stages of imitation and copying) and thus tried not to establish further assembly factories in South Korea so South Korea could bit compete with them in the future. Examples included the refusal of the Japanese Mitsubishi Company to renew the technological auto engine license to the Korean Hyundai Company and the refusal of the US companies to sign technological licensing contracts with the Korean LG Company to manufacture color TVs.

South Korea's spending on foreign technological transfer licenses rose from USD 0.8 million in 1960–1966 to USD 1.2 billion in 1982–1988, i.e., more than 500 times. The spending on foreign technological consultancy increased from USD 17 million in 1967–1971 to USD 333 million in 1982–1986 [11].

Thus, research and innovation started to gain momentum. The desire to improve scientific and research capabilities resulted naturally from a natural sequence of events in South Korean industry whose hopes were pinned on local research (the national research system) for its growth and to overcome its challenges in the path towards innovation.

The government policy changed from encouraging exports to supporting the indigenous R&D policy at the end of the 1970s and early 1980s [12][13].

Given the time lag between the inputs and outputs in scientific research projects and activities, it is not easy to trace the development of the national research system across time based on outputs, which may take a decade or more to impact the economy [14][15]. Therefore, the researchers will chronologically track some of the most prominent inputs to these activities contributed by the South Korean government during the transition to a policy of supporting research and innovation. However, the researchers assert that the outputs of these activities did not bear fruit until at least one to two decades later. The government focused on local knowledge stock, the development of which would enable industry to progress and develop without relying entirely on imported foreign technologies, which were no longer available to South Korean companies as they were before in the 1960s and 1970s for fear of competition. The local knowledge stock increased the capacity of local technological absorption and paved the way for developing imported technologies and producing innovations.

5. South Korean R&D Policies

The government policies to support research and innovation in a bid to develop the capacity of local industry comprised tax exemptions/relief on the income of research and innovation activities in 1975, income tax exemptions of up to 50% for researchers and engineers in 1980 (and later tax exemptions on the income of profits from the proceeds of patents), tax exemptions for R&D-based SMEs in 1985, a compensation system for investment losses for venture capital companies in 1980, tax exemptions on real estate containing R&D institutes in 1981, and a tax credit system spent on developing the workforce in 1986 [16].

Other government policies included providing incentives and benefits to companies and the private sector as the main players in the innovation process, and keeping the government as a regulator and supporter. The government established Daedeok Innopolis as the first science park in Korea in 1979 in addition to direct government spending to support research. As a comparison, government R&D support in 1963 was KRW 1.2 billion, compared with KRW 211 billion in 1980, an increase of nearly 200-fold in less than two decades. It then rose from KRW 211 billion in 1980 to KRW 3.4 trillion in 1990, i.e., a 3000-fold increase in just two and a half decades, and it later increased to KRW 43 trillion won in 2010. These figures indicate the government's interest in research and innovation and its expected role in the country's future, especially after the shock of the non-renewal of technological licenses. The percentage of spending on R&D of the GDP rose from 0.44% in 1976 to 1.59% in 1985 and exceeded 3.7% later in 2010 [6][13].

Given these government measures, the number of full-time researchers increased from approximately 11,000 in 1976 to 100,000 in 1995, i.e., a ninefold increase over two decades, thus raising the number of researchers per 1000 population from 0.33 to 2.24 in the same period and then to 15.4 per 1000 population in 2019 [16][17].

The innovative output of the South Korean research system increased from 50 patents filed with the USPTO for South Koreans in 1980 to more than 5000 patents filed in 2000, i.e., 100 times more within 20 years [12].

The technological content (the added value of goods manufactured in South Korea) increased over time. As a result, decades later, in 2000, 23.4% of South Korea's exports were classified as advanced technologies. Approximately 68.8% of South Korean exports were electronic exports [16].

Such technological progress was reflected in the average annual GDP growth, from 7.5% in the 1960s to 8.6% in the 1970s and 9.3% in the 1980s, i.e., twice Japan's economic growth of 4.5% and twice the US's growth of 3.2% [18].

The governmental measures of support and tax exemptions contributed to a gradual increase in the private sector's contribution to financing research, as the ultimate beneficiaries of research and innovation outputs to improve production lines and industry in general. The private sector's contribution amounted to 81% of total spending [19].

Only 10% of R&D was carried out in universities, while the private sector and research institutions took over the rest. Approximately two-thirds of researchers worked in the private sector. In 2000, Samsung spent more than USD 500 billion on research and innovation, prompting a researcher to publish a chapter in a book entitled *The Samsung Republic*. Its employees exceeded 287,000, and its annual profits amounted to USD 121 billion. Recently, the percentage of Samsung's spending on R&D exceeded government R&D spending as a whole, as it reached 22%, compared with 20% by the government [11].

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