Reflections and Suggestions on the Development of China's Financial System in Support of Technological Innovations and the High-Quality Development of Manufacturing[1]

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Abstract: China's technological innovation system is divided into three stages: the fundamental innovation stage of "0 to 1," the research commercialization stage of "1 to 100", and the mass production stage of "100 to 1 million." Currently, China's "0 to 1" stage is relatively weak, mainly due to insufficient investment. In the next 10-15 years, it is necessary to increase the proportion of funding for this stage in GDP to 20% by 2035 to catch up with the average investment level of developed countries. In the "1 to 100" stage, there is an urgent need to cultivate professional commercialization teams and continue to optimize incentive mechanisms, where the common practice of "three 1/3" in the distribution of intellectual property revenue can serve as a good reference for effectively enhancing the conversion rate. The "100 to 1 million" stage involves full interaction with the capital market. A capital market that truly supports the sci-tech industry needs to provide long-term tracking and professional management of various rounds of financing throughout a company's listing process, sharing the risks and rewards of innovative development and avoiding speculative practices. Furthermore, there is a need to further improve the institutional arrangements of the Sci-Tech Innovation Board and its delisting mechanism.

Manufacturing is a key link in transforming all scientific and technological achievements into productivity. In recent years, China's manufacturing has formed a new comparative advantage, namely the cost dilution brought by scale effects. However, the sector's main weakness currently lies in the limited scale of producer services. The high-quality development of manufacturing in the future depends on whether we can overcome this weakness.

I. Inadequate Investment in the "0 to 1" Phase

Technological innovation is a core foundational component in the development of the national economy, particularly the manufacturing sector. Many of the bottleneck problems our country currently faces are related to insufficient technological innovation. Strengthening scientific and technological innovation is a key strategy for our country to build a new development pattern that focuses on domestic circulation as the mainstay, with domestic and international circulations reinforcing each other. It is also a core driving force behind the development of the Chinese economy.

The technological innovation system of our country

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can be divided into three stages. The first stage is the critical "0 to 1" stage, which involves creating something out of nothing in frontier technologies and intellectual properties. At this stage, our country's current challenge is the lack of sufficient investment.

The "Communiqué on National Expenditures on Science and Technology in 2022" jointly released by the National Bureau of Statistics, Ministry of Science and Technology, and the Ministry of Finance shows that in 2022, China's total investment in Research and Development (R&D) exceeded 3 trillion yuan, and the intensity of R&D expenditure as a percentage of GDP reached 2.54%. Among more than 200 countries and regions worldwide, China ranks second in total R&D funding, just behind the United States, indicating that the scale of our R&D investment is still quite significant.

The issue is, out of the total R&D investment of over 3 trillion yuan, only a small portion, about 7%, is actually allocated to major scientific research projects in the "0 to 1" stage. This figure was even lower in previous years, at around 5%.

In comparison with developed economies in the Group of Twenty (G20), their investment in the "0 to 1" innovation phase often accounts for more than 20% of their GDP. These countries are already ahead of China in R&D, with even greater R&D intensities, they naturally outpace China in this aspect. Although China's total R&D investment is not small, only about 7% is directed towards the "0 to 1" phase, which points to our investment insufficiency in this respect.

In the next 10-15 years, we should increase this proportion. For example, by 2025, we should aim for 10% of R&D funds into the "0 to 1" innovation phase, 15% by 2030, 20% by 2035, to catch up with the average investment level of developed countries. This will help China achieve new heights and breakthroughs in major scientific research areas.

II. Successful Commercialization Requires Professional Teams and Better Incentive Mechanisms

The second stage is "1 to 100," which involves the conversion of research outcomes into marketable products and services. We have made significant "0 to 1" breakthroughs, but how do we transform these achievements into productivity? We've tried to convert scientific research into productivity and bridge the gap between universities and industries for decades, but why is it so difficult to make it happen?

In fact, the conversion rate in our country is only about 10%, while in developed countries, the rate in the "1 to 100" phase is generally around 50%. Of course, we are not asking to convert every research outcome into productivity, but it is reasonable and necessary to expect a conversion rate of 50%.

The low conversion rate of our country's scientific research achievements has a lot to do with the incentive mechanism. Under the current incentive mechanism, after any research team or individual obtains a patent, 70% of the patent's economic benefits goes to the team or individual who obtained the patent, and 30% goes to the investors.

Transforming scientific research into productivity requires not only IQ but also EQ. It entails the understanding of various aspects of the production process. From this perspective, the incentive system should not only motivate scientists to actively explore and invent but also provide sufficient incentives to the commercialization team.

In reality, those who achieve technological breakthroughs in the "0 to 1" phase are usually a bit "nerdy", working towards an answer even if they keep hitting dead ends. These talents often have very high IQs, who tend to achieve lightning breakthroughs in their respective fields.

Talents with high IQs do not necessarily possess high EQs, while commercialization professionals need a broad range of knowledge and the ability to be observant and listen to various perspectives, in order to determine the direction of conversion and create social demand. They also need to have strong organizational skills to foster collaboration between various teams, because the conversion of scientific and creative results involves multiple processes and the aggregation of talents.

Therefore, the talents who promote the conversion of scientific achievements and those who achieve innovative breakthroughs are often two different types of talents, and the conversion teams and innovation teams are also often two different teams. In this sense, it is necessary to encourage different talents to play different roles.

When we talked about technological innovation in the past, we usually talked about developing a number of science and technology innovation bases, lowing house rental costs for R&D personnel, and providing some subsidies. However, when these people leave research labs and move to the bases, they tend to “derail.” This is often because these researchers themselves are unable to raise funds for various conversion tasks, hence there is an urgent need to build professional conversion teams to carry out related work.

Internationally, a commonly used incentive scheme is “three 1/3”: after a scientific achievement is made, one third of the proceeds goes to the investor, one third to the inventor, and one third to the converter. If the inventor also manages to successfully convert the invention, then two thirds of the proceeds go to the inventor, and one third to the investor.

The “Bayh-Dole Act”, proposed by U.S. Senators Birch Bayh and Robert Dole, is a case of the “three 1/3.” This act was passed by the U.S. Congress in 1980 and amended in 1984. Essentially, it is Chapter 18, “Patent Rights in Inventions Made with Federal Assistance,” of the United States Patent Law, and it has been in effect in Silicon Valley for over forty years.

Under the “Bayh-Dole Act,” the commercialization of a large number of research findings in Silicon Valley relies not only on the continuous emergence of innovations from universities but also on the fact that Silicon Valley itself is not only a base for invention but also for commercialization. A large number of students “go in with books in backpacks and come out with money in wallets,” which essentially describes a route for converting academic research into commercial outcomes via entrepreneurship. They discuss issues of commercialization in basements and cafes. Once successful, the convertors can share the profits with the inventors from universities. In this sense, our country should also implement the “three 1/3” scheme of intellectual property profit distribution in the commercialization phase to achieve an increase in the conversion rate.

III. Improve the Delisting Mechanism and Strengthen the Fundamental Institutional Management of the Capital Market

The third stage of technological innovation is the mass production process of “100 to 100,000”. This process requires the support of the capital market to provide various public and private equity investments. Prior to this, angel funds and seed funds may be needed. The industrialization of research outcomes involves Series A, B, C, and a number of funding rounds until the company goes public and becomes a unicorn.

The promotion of a multi-tiered capital investment and financing system in the capital market can help translate research findings into mass-produced factory products. At the same time, startups that turn these findings into products and services also grow into unicorns in the market.

Overall, China’s development in this third stage is also not adequate. Currently, domestic companies listed on the Sci-Tech Innovation Board that truly form a scale and can be called “unicorns” account for less than 10% of the total market value of the capital market, while the market value of American unicorn companies accounts for about 30% of the total value of U.S. stocks. From this perspective, one of the core differences between our capital market and the U.S. capital market is reflected in the total market value of unicorn companies.

In summary, currently, our country has shortcomings in the above three phases, which need to be addressed in the development of the future technological innovation system.

The development of financial support for technological innovation is related to the fundamental institutional management of our capital market.

For instance, unicorn companies often begin to take shape during the commercialization of research discoveries, which involves the use of Series A funding. The creation of a viable product requires further investment involving Series B and C funding. As the industrial chain expands and matures, leading to scale effect, a company can go through an IPO and become a listed unicorn.

A capital market that can truly support the tech industry needs to provide long-term tracking of financing rounds and professional management of funds throughout the entire listing process of a company, to share the risks and rewards of innovative development and to avoid speculative shortcuts.

The current issue is that some investors "do not see the good stuff." Some may control hundreds of billions in funds but invest 90% of it in money market funds, bond funds, and other financial products, an unproductive choice that fails to drive the development of China's technology finance or technological innovation. This is a phenomenon that future capital market development should avoid.

Currently, China's publicly offered funds are close to 30 trillion yuan, with 70%-80% invested in the bond market, very little in the stock market, and even less in unicorn enterprises.

Additionally, some investors are too short-sighted and tend to have little interest during the Series A, B, and C funding stages and seeking equity by any means possible when a company is about to go public and become a unicorn. That is, they only hope to make quick money when reaping the results. The influx of funds in the last stage can drive up operating costs and lead to abnormal stock prices.

Furthermore, it's necessary to further promote the establishment of the Sci-Tech Innovation Board system and improve the delisting mechanism.

Companies on the Sci-Tech Innovation Board are often not yet mature in development, and their financial statements cannot meet the admission standards of other listed companies. Essentially, these are high-risk tech enterprises that have not yet achieved input-output efficiency. Not all companies listed on the Board through the registration system will necessarily develop into quality unicorns. In fact, maybe 60% or even 70% of them will not become unicorns. Therefore, for the future development of the Sci-Tech Innovation Board, it is crucial to improve the delisting mechanism.

If the Sci-Tech Innovation Board "only allows listing but not delisting," the consequences will be much more severe than the typical capital market's "many listings and few delisting." The overall stagnation of the sector will undoubtedly be borne by the investors.

If the majority of the companies listed on the Sci-Tech Innovation Board continue to perform poorly, then the general public, as well as public and private funds, will inevitably lose confidence in the stocks of the Board. Conversely, the more prosperous the Board, the more profits investors make, the more it will attract social funds. The world is not short of funds, but what is lacking are projects with good returns and truly quality unicorn companies with great potential.

IV. High-quality Development in Manufacturing Needs a Larger Producer Service Sector

Currently, China's manufacturing sector is the largest in the world, accounting for about 30% of global manufacturing, and capable of production at an ultra-large scale. The scale effect brings some unique advantages to Chinese manufacturing:

First, a complete industrial chain. The United Nations' industrial system classification includes 39 major categories, 191 sub-categories, and 525 minor categories. China covers all these categories, boasting the most comprehensive manufacturing industrial chain globally. In this classification system, China leads globally in about 30% of the categories, demonstrating the advantage brought by the country's complete and complementary industrial chain.

Second, cost dilution as a result of scale effects. In the 1980s and 1990s, China had a large labor force with relatively low wage standards, and thus formed a comparative advantage in low-cost labor. This advantage persisted over the past three to four decades, but in the last decade, China's labor costs have tripled. For example, in 2004, the minimum wage in Shanghai was 600 yuan per month, which rose to 1820 yuan in 2014 and is now 2590 yuan. In terms of labor costs, China's manufacturing no longer has a comparative advantage compared to Southeast Asia and India.

Now, China's manufacturing has formed a new comparative advantage: the cost dilution effect brought by scale effects. China's massive market reduces manufacturing costs in six ways: First, the scale effect dilutes R&D costs. Intuitively, if a company spends a hundred million yuan on developing a product and then sells one hundred million units in the market, the R&D cost per product is one yuan. If the company sells two hundred million units, the R&D cost per product is fifty cents. Thus, under the same total R&D expenditure, the scale effect reduces per unit R&D costs. Similarly, second, the scale effect reduces fixed asset costs; third, it lowers logistics costs; fourth, it dilutes market development costs. Fifth, the scale effect dilutes procurement costs, as the company has more bargaining power when it purchases more raw materials and parts from its suppliers. Sixth, the scale effect increases labor productivity, reducing per unit labor costs. The same group of workers, under the same wage standards, will have higher productivity in a company with more orders and larger market demand. In contrast, another company employing the same workers at the same wages but with fewer orders will have lower labor productivity.

The reduction in costs in these six areas of China's manufacturing sector has led to fundamental and structural changes in the competitiveness of Chinese exports over the past decade. In the 1980s, 1990s, and early this century, 70% of China's export products were labor-intensive, such as light industrial and textile products. However, in the recent decade, 90% of China's export products are mechanical and electronic products, which are capital-intensive and technology-intensive. The proportion of labor-intensive export products has decreased from the original 70% to the present 8%.

This change was not the result of new export policies set by the Chinese government but rather a market-driven, unperceived transition. On one hand, the low-cost advantage of China's labor-intensive products gradually dissipated, leading foreign companies to import these types of products more from regions such as Southeast Asia and India. On the other hand, China's scale effect diluted costs in six areas, creating new competitive advantages. As a result, foreign companies naturally increase their purchases of China's capital-intensive and technology-intensive products.

Because of the large exports of Chinese mechanical and electronic products to Europe and America over the past decade, some in the U.S. have often suspected the Chinese government of covertly subsidizing these enterprises, leading to numerous anti-dumping investigations. However, almost every case turned out to be much ado about nothing. This is because the investigations ultimately revealed that the Chinese government had not provided any subsidies, and the competitive edge of Chinese mechanical and electronic products naturally arose from scale effects.

Currently, many of China's manufactured products cost about 50% to 60% less than their counterparts in Europe and America. In this sense, relying on the new core competitiveness brought by scale effects, the scale of China's manufacturing sector will only continue to grow in the next decade or even decades, which is an irreversible trend.

The scale advantage of China's manufacturing sector will persist for decades to come, becoming a key factor in attracting foreign investment and integrating China into the world. The scale of China's annual goods import is about 3 trillion USD, and that of services import is about 500 billion USD. Together, the scale of total annual import is about 3.5 trillion USD, amounting to 35 trillion USD over 10 years. In this sense, multinational companies from Europe, the U.S., or elsewhere are all eager to share a piece of the Chinese market.

The scale of China's industrial sector has also played a ballast role in the development of the global economy and manufacturing. On one hand, regardless of any regional fluctuations, as long as Chinese manufacturing remains stable, 30% of the world's manufacturing can operate smoothly. This has become an aspect of mutual benefit and win-win between the world and China. On the other hand, Chinese manufacturing provides the world with a large number of low-price products, playing an important role in taming global inflation.

The high-quality development of manufacturing in the future relies on further eliminating our weaknesses. Currently, the main shortcoming of Chinese manufacturing lies in the limited market scale of the producer service sector.

In various high-quality manufacturing systems globally, 50%-60% of the value of end products is in service. For example, for a smartphone priced at 6000 yuan, the total cost of thousands of components might only account for about 45% of the total value of the phone. The invisible and intangible software programs, operating systems, chip patents, and other service values might account for 55% of the total value of the phone. From this perspective, only markets with a sufficiently large producer service sector can endow end products with more intellectual property value-added.

Behind this phenomenon, the industrial structure of developed countries is also changing. The scale of the producer service sector in developed countries often accounts for 40%-50% of GDP, while in China, it accounts for about 20% of GDP, about half that of developed countries. Increasing the proportion of the producer service sector in GDP is an important step toward further developing high-quality manufacturing in China.

The focus of high-quality manufacturing is not on the manufacturing sector itself, but on the producer service sector. Producer service sector, in the statistical systems of the National Bureau of Statistics and around the world, can be generally divided into 10 types.

First, R&D around products and industrial chains.

Second, financial services related to the industrial chain, including the R&D investment of unicorn companies and financial leasing, REITs, etc., of various enterprises in the industrial chain.

Third, the logistic transportation system of the industrial chain, such as freight logistics, multimodal transport, etc.

Fourth, inspection and testing of finished and semi-finished products of various enterprises in the industrial chain, and their market access.

Fifth, digital technology empowerment in the industrial chain. Digital platforms based on big data, cloud computing, artificial intelligence, and blockchain integrate and empower traditional industrial and commercial industries, transforming factories into an industrial internet system.

Sixth, ecological services and green, low-carbon services in the industrial chain, which can reduce energy consumption in China's industrial chain.

Seventh, protection and promotion of patents and brands.

Eighth, after-sales services for various products sold, including various information consulting, accounting, and legal services.

Ninth, various types of trade and wholesale in the industrial chain, including physical trade, internet trade, and cross-border e-commerce, etc.

Tenth, different types of professional service outsourcing needed for various segments of the industrial chain.

If these 10 types of producer services collectively can account for 50% of the national service sector, and the service sector accounts for 60% of the national GDP, then the proportion of producer services in the GDP would be around 30%, which would be a crucial progress.

Currently, more than two-thirds of China's service sector is lifestyle-oriented, catering to demand for clothing, food, housing, transportation, education, health, culture, sports, tourism, and wellness. The lifestyle service industries are labor-intensive and characterized by short industrial chains, low added-value, low skills, and low knowledge requirement. If we continue to maintain a structure where the service sector accounts for about 60% of the national GDP, and 2/3 of the service sector is lifestyle-oriented, then China's service sector faces the risk of shifting away from the real economy.

If China's GDP doubles to 240 trillion yuan, with the service sector still accounting for 60% of GDP and the lifestyle-oriented service industries still accounting for 2/3 of the service sector, then China's lifestyle service industries would reach a scale of 90 trillion yuan or an output of over 200 trillion yuan. Distributed among the nation's population of over a billion people, this would equate to around 200,000 yuan in lifestyle services per person, clearly indicating a bubble.

It can be said that a manufacturing sector without a significant proportion of producer services mean low-level, low value-added industrial products. High-quality manufacturing can only be achieved when the scale of industrial products is large and the scale of producer services is even larger. In summary, the development of high-quality manufacturing must focus on the development of the producer service sector. Without a significant proportion of producer services in place, China cannot realize the development of high-quality manufacturing.