Chapter 2
Innovative Development

As can be seen from the common characteristics of modern economic development, a country or region in different development levels or stages will have different driving forces of development. In general, a country or region in the low-income stage is basically driven by primary elements such as land, resources, energy, and a labor force, whereas a country or region in the lower middle-income stage is largely driven by capital elements such as the domestic savings rate, investment rate, and investment scale, which are of great importance. In contrast, a country or region in the upper middle-income stage is driven by technological elements, which are usually associated with the introduction of large-scale technology, and one in the high-income stage must be driven by a reliance on innovation.

Looking at the various characteristics of the different stages of economic development, China is entering a phase of "new normal" in terms of economic development, transforming from high-speed growth to high- and medium-speed growth, from quantitative expansion to structural optimization, from low- and medium-end to high- and medium-end goods, and from capital-driven development to innovative technology-driven development. Only by adhering to innovative development is it possible to provide new ideas to address the problem of economic and social development, to provide a new impetus for economic and social development, and successfully step over the middle-income trap. In this way it is also possible to guide China's new normal economy, and realize the transformation of China's economy from a middle-income to a high-income economy. Thus, these changes represent the historical transformation of China from one of the biggest economic powers in the world to the greatest economic power in the world.

From the perspective of the external macro environment of economic development, opening-up and competition currently represent the general background, trends, and megatrends of world development. A new round of technological and industrial revolution is emerging. The current competition of national strength centered on innovation has become the dominant force reshaping the worldwide economic pattern. Major countries have successively launched new national innovation strategies in search of breakthroughs in scientific and technological

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innovations, and they have taken the lead in mapping the future. Furthermore, they are seizing new opportunities for future economic, scientific, and technological development, and have acquired first-mover advantages. Only by adhering to innovative development, engaging in world-leading development that is driven by innovation, and with a strong emphasis on first-mover advantages can China work hard to catch up to or even surpass advanced countries within the arena of scientific and technological innovation in the global arena. Furthermore, China will become the innovator and guider, realize its transformation from a power of technology imitation to a power of technology innovation, and March toward its role as one of the greatest scientific and technological powers in the world.

Innovative development is the driving force to maintain China's high- and middle-speed economic growth in the future, and is the key way to escape the middle-income trap. China's ability to realize its transformation from catch-up growth to endogenous innovation growth, its transform from innovation imitation to independent innovation, and shift from being a follower to leading development represent a general direction and grand strategy to exploit its socialist development path with Chinese characteristics. Additionally, this has both realistic significance and far-reaching historical significance in the attempts to achieve the goal of building an all-round moderately prosperous society by 2020, and then realize the century-old dream of the great rejuvenation of the Chinese nation.

2.1 Concept Origin

The origin of the concept of innovative development includes the following three aspects:

A. Innovative development is rooted in the philosophical thoughts of Chinese civilization for thousands of years, runs in the cultural traditions of the Chinese nation, and is a historical gene of China. As early as in the Yinzhou Dynasty there existed the concept of innovation that "all beneficial ways keep pace with the times", as recorded in the *Changeable Divination* and *The Book of Changes*, inspiring us to understand the rules and general trends, as well as keep pace with the times. Furthermore, it asks that we seek the truth from facts, and keep up with the times via innovative ideas, innovative methods, and innovative technologies, so as to both achieve and control the direction we are traveling. In the Ming Dynasty, the enlightenment thinker Li Zhi also expressed the same simple dialectical materialism thought, and espoused that "what was correct yesterday is wrong today, and what is wrong today will be correct the day after tomorrow".[1] That is, the world changes over time, the situation changes to produce new conditions and new problems, and we can see the trends of the time only by

[1]The quote comes from *Collection of Books & Introduction of Total Contents of Century Biographies*.

maintaining a state of innovation. Furthermore, we can walk in the forefront of the times only by constantly breaking free from tradition and updating our ideas.

"If you can make things better for one day, you should make them better every day and never stop doing this!" The *Book of Rites & the Great Learning* emphasizes the necessity and continuity of innovation from a dynamic angle. It is necessary to maintain innovation to adapt to and promote social progress. In the Northern Song Dynasty, Cheng Hao and Cheng Yi, the founders of neo-confucianism, explained the importance of continuous innovation from a different angle, stating that "a gentleman must make new gains every day during study. A person making gains every day makes progress every day. A person without gains every day must step backward every day. There is no person who neither makes progress nor steps backward."[2]

The innovative ideas and humanistic spirit of Chinese civilization are not only reflected in famous sayings such as "Zhou is an old country state, but its mission is innovating",[3] "if the world has changed, everything will also change accordingly; and if the situation has changed, political and social policies must also change accordingly",[4] but also in the wisdom of the people, which have become common proverbs long ago. For example, "poverty leads to changes, and changes lead to finding a way out, which in turn becomes sustainable".[5] These very profound cultural connotations can help us to not only review the past, predict the future, and overcome all difficulties during a period of deepening reform, but can also add pillars of faith in the executive power so that we are more confident in considering problems and handling affairs.

B. Innovative development comes from reference to and exceeding Western traditional theory. According to the classic innovation viewpoint of capitalism proposed by Schumpeter, innovation is revolutionary change, and also means to "destroy" original products, technologies, and production modes. This "innovation" means to establish a new production function, and introduce an unprecedented and "new combination" of production elements and production conditions into the production system.

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[2]Quote comes from *Collection of the Works of the Cheng Brothers & Posthumous Writings of the Cheng Brothers from Henan*, Vol. 25.

[3]Quote comes from the *Book of Songs & Jedaiah & King Wen*, the original text states, "King Wen has the spirit of a martyr in heaven, and his brilliance most brightly illuminates the sky. Zhou is an old country state, but its mission is innovating."

[4]Quote comes from *Hanfeizi & Five Beasts* written by Han Fei in Warring States.

[5]Quote comes from the *Book of Changes & the Great Appendix*, the original text reads, "After the death of Shennong, Yellow Emperor, Yao and Shun succeeded to the throne in succession, not only inheriting Shennong's method of managing state affairs, but they also made changes in view of the general environment so that the masses had ample food and clothing. After Shennong's method of managing state affairs was changed, the masses lived and worked in peace and contentment. Poverty leads to changes, and changes lead to finding a way out, which in turn becomes sustainable." Therefore, "only those helping themselves can get help, and only those striving to become stronger relying on themselves can have good luck and make a high profit".

The subjects of innovation are entrepreneurs whose function is to realize "innovation" and introduce the "new combination"—these features are seen as the "soul" of capitalist development. Economic development within this system is the process in which the whole capitalist society constantly realizes the "new combination" under the guidance of the innovative spirit of entrepreneurs.

Innovation specifically includes five categories: (1) introducing new products; (2) citing new technologies, namely new production methods; (3) opening up new markets; (4) controlling new supply sources of raw materials; and (5) realizing new organizations as enterprises.[6] Thus, Schumpeter regards innovation as the endogenous development impetus of an economic entity, and considers that innovation is an internal factor, and that economic development represents "a change in economic life from internal creativity". In this sense, Schumpeter's theory reveals the endogenousness of economic development.

At present, while China's socialist innovation refers to and absorbs the essence of Schumpeter's innovation, it also goes beyond its limitations and covers common innovation and the shared innovation of billions of people. For example, in Chinese innovation, such as "Internet Plus", innovation is not destructive or disruptive; it is constructive or collaborative. Furthermore, it is not only entrepreneurs who innovate, but also hundreds of millions of people and politicians. Furthermore, there is not only technical innovation and market innovation but also concept innovation, institutional innovation, mechanism innovation, and system innovation.

C. **Innovative development is the most important theoretical cornerstone provided by Marxist political economics for the development of contemporary China**.[7] Based on the fundamental standpoint of all-round human development, Marxist political economics emphasizes that the human practice shall consciously understand and respect the laws of economic development, social development, and natural development, and the fundamental impetus of social development lies in the development of productive forces.

The core development idea of contemporary China has been gradually established and improved based on the theory of Marxist political economics. Marx clearly indicated that, "the labor productivity of the society is first the scientific strength".[8] On how to develop scientific strength and promote the development of productive forces, as early as in the semi-closed stage after the founding of the New China, Mao Tse-tung creatively lodged an objection against "crawlism" to achieve development gains in science and technology. He stated, "we cannot insist on the

[6]Joseph Schumpeter: *Theory of Economic Development* (Chinese version), Beijing: China Commerce & Trade Press, p. 74, 1991.

[7]Hu Jintao: Speech at the Report Meeting of Leaning *Selected Works of Jiang Zemin*, August 15, 2006.

[8]*Complete Works of Marx and Engels*, pp. 211 and 217, Vol. 46.

ready-made principle of technology development in various countries around the world, i.e., we cannot crawl behind others step by step. We must break the routine, and develop China into a great power of socialist modernization in a short historical period using advanced technology as far as possible".[9] This idea of innovative development laid the ideological foundation to centralize China's nationwide strength regarding science and technology, using its second-mover advantage and socialist superiority, and realizing the development gains of major scientific and technological projects.

After the reform and opening-up, the CPC Central Committee constantly presented new ideas and concepts of innovative development, transforming Deng Xiaoping's theory that "science and technology constitute one of the productive forces"[10] to "science and technology is the primary productive force".[11] The same applies to Jiang Zemin's theory that "innovation is the soul of a nation's progress and the inexhaustible impetus of a power's prosperity",[12] to Hu Jintao's demand to "insist on the principle of independent innovation, and build an innovative power (in the world)",[13] and later Xi Jinping's aim to "implement the strategy of innovation-driven development" and "speeding up transformation from giving priority to element-driven and investment scale-driven development to giving priority to innovation-driven development".[14]

The evolution and continuation of lines of thought on innovative development have enriched and developed the concept of socialist development with Chinese characteristics, done so by the CPC's firm grasp of the analysis method and basic theory of Marxist political economics. This represents the sublimation of the perceptual knowledge of the CPC Central Committee in promoting economic development, the result of the Committee guiding the reform practice. Thus, in adapting to new situations, understanding new problems, and by carefully summarizing China's concept of development, the CPC Central Committee has achieved many theoretical achievements.

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[9]Mao Tse-tung: *Construction of China to a Great Power of Socialist Modernization*, *Collected Works of Mao Tse-tung*, p. 341, Vol. 8, Beijing: People's Publishing House, 1999.

[10]Deng Xiaoping: *Speech at the Opening Ceremony of the National Science Conference*, *Collected Works of Deng Xiaoping*, p. 861, Vol. 2, Beijing: People's Publishing House, 1994.

[11]Deng Xiaoping: *Science and Technology Is the Primary Productive Forces*, *Collected Works of Deng Xiaoping*, p. 274, Vol. 3, Beijing: People's Publishing House, 1993.

[12]Jiang Zemin: *Strategy of Rejuvenating China through Science and Education*, *Collected Works of Jiang Zemin*, p. 432, Vol. 1, Beijing: People's Publishing House, 2006.

[13]Hu Jintao: *Insist on the Principle of Independent Innovation with Chinese Characteristics, Strive To Build an Innovative Power*, January 1, 2006.

[14]Xi Jinping: *Speech at the 17th Conference of Academicians from the Chinese Academy of Sciences, and at the 12th Conference of Academicians from the Chinese Academy of Engineering, Xi Jinping: The Governance of China*, p. 119, Beijing: Foreign Languages Press, 2014.

2.2 Practical Innovation

Reviewing China's development course over the last 60 years or so, China has developed from a "poor and blank" lagger in modern science and technology, to a big power in science and technology with important worldwide influence. Thus, China's independent path to innovation represents China's innovative development path, and the innovative development path now signifies China's successful development path. China's innovative development path also provides technologically backward countries with a guide for "overtaking on the bends", helping them to transform from laggards to pursuers, and, ultimately, overtakers.

Mao Tse-tung started modern China's historical period of independent innovation. The basic conclusion of the CPC Central Committee at that time was that science and technology in China lagged decades behind those countries with the most advanced science and technology in the world.[15] In January 1956, Mao Tse-tung stated at the 6th Supreme State Conference, with some foresight, that, "the Chinese people should have a long-range plan, strive to change the economic, scientific, and cultural backwardness of China within a few decades, and quickly reach the most advanced level in the world".[16] Based on this grand idea, the Chinese government formulated the *1956–1967 Long-Range Plan of Scientific and Technological Development*, a policy of scientific and technological catch-up by "focusing on development, and coming up from behind", and outlined 57 major tasks to be achieved in 13 areas. The plan also specifically indicated that although the basic principle was to strive for self-reliance, it was necessary to respectfully learn about other countries' strengths, and then combine such scientific inheritances with China's experiences.[17] This represented the first technology development blueprint for the New China to improve its backwardness in science and technology and pursue the dream of advanced countries. It also laid the foundation for the development of China's science and technology.

By 1964, "China had a number of world-class scientists and engineers, and some research achievements had reached or been close to the advanced global level".[18] The scientific and technological gap between China and developed countries was quickly narrowed, and a number of goals for scientific and technological catch-up were achieved. To this end, Mao Tse-tung clearly presented the catch-up route: "we cannot insist on the ready-made principle of technology development in various countries around the world, that is, we cannot crawl behind others step by step. We

[15]CCCPC Party Literature Research Office: *Selected Works of Important Literatures since the Founding of New China*, p. 374, Vol. 9. Beijing: Central Party Literature Press, 2011.

[16]Mao Tse-Tung: *Socialist Revolution Aims at Liberating the Productive Forces*. *Collected Works of Mao Tse-tung*, p. 2, Vol. 7, Beijing: People's Publishing House, 1999.

[17]CCCPC Party Literature Research Office: *Selected Works of Important Literatures since the Founding of New China*, p. 378, Vol. 9. Beijing: Central Party Literature Press, 2011.

[18]CCCPC Party Literature Research Office: *Collected Works of Mao Tse-tung since the Founding of New China*, note on p. 287, Vol. 11. Beijing: Central Party Literature Press, 1996.

must break the routine, and develop China into a great power of socialist modernization in a short historical period using advanced technology as far as possible".[19]

In the late 1970s, China entered an exploratory period of opening-up, catch-up, and innovation. In March 1978, Deng Xiaoping first presented his famous statement that "science and technology constitute one of the productive forces" at the National Science Conference. It was at this conference that the *Outline (Draft) of the 1978–1985 National Scientific and Technological Development Plan* was formulated and the goal of scientific and technological work was presented. In December 1985, the Communique of the 3rd Plenary Session of the 11th CPC Central Committee further stated to "actively develop economic cooperation with various countries around the world based on equality and mutual benefit on the basis of self-reliance, and to strive to adopt world-class advanced technology and advanced equipment".[20] The CPC Central Committee also established a fundamental policy where China shall give priority to technology introduction and ensure that science and technology plays the role of a primary productive force.

The pioneering stage of innovative development in China lasted from the end of the nineteenth century to the beginning of this century. The main aim of this stage was to exploit the path of independent innovation, and to implement a strategy to rejuvenate China through science and education. In September 1995, the 5th Plenary Session of the 14th CPC Central Committee first presented its plans to implement a strategy to rejuvenate China through science and education, and for science, technology and education to be closely combined with the economy. This strategy included the following aims: (1) accelerate the commercialization and industrialization of scientific and technological achievements; (2) actively develop high-technology and related industry; (3) strengthen basic scientific research, focus on cutting-edge science, overcome key difficulties, and strive for major breakthroughs in key fields.[21] In general, the route was still to follow the science and technology of developed countries, but also to accelerate the process of catching up with these countries, and to especially narrow the relative gaps in informatization, networking, and high-technology.

In January 2006, Comrade Hu Jintao more clearly stated that China shall adhere to the principle of independent innovation with Chinese characteristics, and aim for the enhancement of the ability of independent innovation right through to various aspects of modernization. To this end, the State Council formulated the *National Medium- and Long-term Plans for Science and Technology Development (2006–2020)*, and presented the specific goal of creating an innovative country by 2020.

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[19]Mao Tse-tung: *Construction of China to a Great Power of Socialist Modernization*, *Collected Works of Mao Tse-tung*, p. 341, Vol. 8, Beijing: People's Publishing House, 1999.

[20]*Communique of the 3rd Plenary Session of the 11th CPC Central Committee*, adopted at the 3rd Plenary Session of the 11th CPC Central Committee on December 22, 1978.

[21]*Recommendations for the 9th Five-Year Plan for Economic and Social Development and the 2010 Long-Range Goal*, adopted at the 5th Plenary Session of the 14th Central Committee of the Communist Party of China on September 28, 1995.

After the 18th Party Congress, China entered its next development stage, comprehensive innovation. The Report to the 18th Party Congress clearly outlined the implementation an innovation-driven development idea. On November 9, 2014, President Xi Jinping further stated at the APEC CEO Summit that the "new normal" would bring new opportunities for China's development, and would shift its innovative development into a new stage. In March 2015, the CPC Central Committee and the State Council issued the *Opinions on Deepening the Reform of the System and Mechanism and Speeding up the Implementation of the Innovation-Driven Development idea*, and presented general thoughts, main goals, and specific measures for innovative development. The 5th Plenary Session of the 18th CPC Central Committee further mentioned innovative development, and "put innovative development at the core of the overall situation of national development". Thus, China entered a phase of comprehensive innovation.

China's new policies reflected the development and sublimation of the CPC's lines of thought on governing and rejuvenating China in the new period. These policies also represented an important cornerstone to guide Chinese innovation to constantly reach new levels and heights. The policies aimed to transform China's main aims as follows:

- From "marching toward science" to "breaking with tradition to achieve leaps in development";
- From "science and technology constitutes one of China's productive forces" to "science and technology is the primary productive force";
- From "the strategy to rejuvenate China through science and education" to "improving the ability for independent innovation";
- From "building an innovative country" to "an innovation-driven development idea" and then ultimately to "adhering to innovative development, and shaping world-leading development that is based on innovation, and maximizing first-mover advantages".

These policies clearly reflect the constantly developing innovative practices of the CPC Central Committee.

From the perspective of China's historical path, whether a nation intends to and has the ability to design and implement a strategy of national innovation is the key to a whether the nation can achieve innovative opening-up, innovative catch-up, and then to encourage innovation from a very low scientific and technological base. In this sense, the innovative development of China is the practical achievements of pursuing, exploring, and innovating the path of development with Chinese characteristics by successive generations of communists. Furthermore, it is the achievements of constant summary and extraction, and the continual deepening of development by the CPC in managing its affairs and dealing with political matters. It is also the significant and realistic achievements of opening up to the outside world, coming from behind, making the greatest efforts to catch up, and striving to catch up with and surpass developed countries as a technologically backward country.

2.3 Definition of Innovation

In terms of China's reform practices, the author defines innovation as "(various) activities creating new social value". There are three key points on this matter: (1) the ability to create new value, rather than relying on existing value; (2) the created value is primarily a social value with positive externalities; and (3) and the various activities related to innovation are not only technological innovation but also innovation to obtain related financing and investments, new technology research and development, the effective protection of intellectual property rights of technological innovation, and the demonstration, application, and promotion of technology innovation.

The previous innovation concept relates to growth without development, science and technology without an appropriate mechanism, and enterprises without people. The innovative development presented by the CPC Central Committee provides innovation with a more profound and comprehensive meaning of these points, so that Chinese innovation will go far beyond any innovative activity in human history.

First, innovative development is different from capitalist economic growth, and denotes the far-reaching innovation of social value. According Schumpeter's definition, innovation means to establish a new production function, and is the process in which a new combination of production achieves new economic value. In innovative development, any activity that can create new social value should be recognized as social innovation. This includes many aspects as follows: entrepreneurs create economic value, scientists create scientific value, engineers create technological value, teachers create human capital value, environmental protection organizations create ecological value, and artists and writers create cultural value that can be retained in history forever.

What is more important is that innovative development, once serving as the driving force and core idea of a nation, not only brings material productive forces but can also be directly converted into scientific and technological productive forces, cultural productive forces, educational productive forces, knowledge productive forces, and ecological productive forces. Therefore, in this sense, the scope of innovative development is extended from innovation in the field of science and technology and innovation in economics to comprehensive innovation, which includes theoretical innovation centered on scientific and technological innovation, institutional innovation, and cultural innovation. Innovative development runs through all aspects of national economic and social development. This not only transcends Schumpeter-style innovation, but also other innovation activities within Western capitalism. From this perspective, China's socialist innovation must be better than Western capitalist innovation, just as the current form of capitalist innovation is superior to the previous capitalist innovation. For example, (1) China enjoys a larger population size and has more innovative subjects than Europe and North America; (2) the national innovation and social innovation led by the CPC go

beyond those of Europe and North America; and (3) China engages in joint innovation with its citizens.

Second, innovative development is not limited to innovation within science and technology, but integrates a variety of innovation mechanisms. The innovative development of China is a process that comprehensively gives play to a variety of mechanisms and realizes integrated innovation from a very low historical starting point, and via the path of "scientific and technological catch-up" by independent innovation. This process reveals the important law of innovative development. That is, as a nation with backward modernization, there is a huge scientific and technological gap with advanced countries, but China has obvious second-mover advantages and scale advantages, and can greatly reduce the catch-up period to countries with advanced science and technology. This can be achieved by using several innovation mechanisms rather than just one as follows:

(1) the mechanism of introducing science and technology (T1); the mechanism of science and technology re-innovation (including how to introduce innovation, imitation innovation and integrated innovation) (T2); and the mechanism of independent technological innovation (T3). In addition, as a large country with a population of billions, China has a unique advantage, namely huge national-market innovation (T4) and a mechanism for world market (T5) scientific and technological innovation.[22] The use of many innovation mechanisms rather than a single tool is the key driver behind China achieving its technological catch-up, information catch-up, knowledge catch-up, and economic catch-up.

Third, the human-oriented and people-centered principle is the starting point, foothold, and core of innovative development. From a starting-point perspective, the fundamental impetus of innovative development comes from the innovation activities of the people, and also includes the innovation of experts, scholars, scientists, engineers, and artists as well as the innovation of 770 million employees and 1.3 billion people; that is, all of China's people. Based on the strategy for innovative development, each innovator is not only a subject of innovation activities, but also a beneficiary, transmitter, and sharer of innovation activities and innovation strategies. The micro-innovations of hundreds of millions of innovators and entrepreneurs at every moment of every day and month will be gathered in an unceasing collection of thoughts, knowledge, and technologies, resulting in the exponential growth of social innovation, and represent innovation on a scale never previously seen in the world.

[22]That is, a large market-scale effect on any technological innovation will not only greatly reduce the economic costs of technological innovation, but also greatly reduce the transaction costs of technological innovation diffusion and application, especially for those major engineering technologies requiring very high investment, and national defense science and technology. At the same time, it is also possible to exploit the overseas market through exports, foreign investment, technology transfer or technology research and development, namely obtaining the advantages of the economies of scale present in the world market.

In terms of the foothold of innovative development, the fundamental purpose of innovative development is to arouse people's vitality, creativity, and productive forces, which are essential for China to move closer to its goal to be an innovation leader. At the same time, national innovation and institutional innovation, from the top to the bottom, are intended to better protect and encourage innovation. For example, patent laws were first introduced in China in 1985, and within 30 years (1985–2015) they have reached the same level of development as the United States. However, it took the US patent system over 225 years (1790–2015) to achieve this status. Furthermore, China has gone beyond the United States to become the largest patent applicant and grantor state in the world.[23]

At the core of innovation development is the essence of socialist modernization—human modernization. In the final analysis, the goal of innovative development is to promote the development of all people, make full use of the superiority and political advantages of the socialist system, continuously invest in the human capital of billions of people, create human development opportunities, and improve the ability for human development.

Promoting innovative development means to form an institutional framework that promotes innovation, and shape world-leading development based on innovation, and to encourage first-mover advantages.[24] The realization of leading development needs to follow the laws of scientific and technological innovation, economic innovation, and institutional innovation.

Regarding the laws of scientific and technological innovation, it is necessary to integrate three types of innovations, namely, original innovation, integrated innovation, and its introduction, digestion, absorption, and re-innovation,[25] and to advocate and promote collaborative innovation transformation.[26] A variety of innovative mechanisms represent the fourth globalization trend to better adapt to future domestic economic integration, regional (referring to East Asia and Asia) economic integration and trade liberalization, and economic integration, trade

[23]China has become the largest invention patent applicant and grantor state in the world. In 2013, the number of invention patent applications in China reached 1.7049 million, 2.45 times that of the United States, and the number of granted domestic invention patents in China reached 143,500, 1.07 times that of the United States.

[24]*Recommendations for the 13th Five-Year Plan for Economic and Social Development*, adopted at the Fifth Plenary Session of the 18th Central Committee of the Communist Party of China on October 29, 2015.

[25]In 2006, China formulated the *National Guideline for Medium- and Long-term Plans for Science and Technology Development*, which clearly presents that China's independent innovation includes three definitions: (1) original innovation, (2) integrated innovation, (3) and the introduction, digestion, absorption and re-innovation of innovation.

[26]Collaborative innovation refers to cooperative innovation between multiple enterprises or enterprises and universities, scientific research institutions or other institutions, which co-share innovation achievements, and further includes collaborative innovation between financial institutions and industrial institutions, multiregional collaborative innovation, and international collaborative innovation.

liberalization, investment liberalization, and service industry facilitation. This is downstream sailing, and conforms to the historical trends of the time.

China was a victim of the first globalization period (1870–1913). This period was interrupted by the First World War, the Great Depression, and the Second World War. The total world trade volume peaked in 1929, during which China was still marginalized and the laggard of the second globalization (1950–1973). China opened-up to the outside world in 1978, and entered the third globalization period in 1990, enjoying continuous catch-up since then, as well as becoming the biggest beneficiary in that phase. From the 15th largest importer and exporter in 1990 to the 2nd largest by 2010, China then replaced the United States in 2013, attaining 1st place. In the fourth globalization period, China walked onto the center of the world stage. Only by expanding its opening-up strategy to the outside world and strengthening collaborative innovation can China lead with cutting-edge scientific and technological development, compete and develop with the rest of world, and finally lead the world.

Regarding the laws of economic innovation, China's economic status has undergone great changes in the last 30 years or so, from 15th in 1978 to 6th in 2000, and then sharply rising all the way to 2nd place in 2010. This development has turned from quantitative (scale) change to qualitative (stage) change, and the major contradictions have also changed accordingly, showing obvious characteristics of different stages. This reflects the basic principle of development economics, that is, the stage theory of economic innovation.

From the perspective of world economic history, an economic entity essentially experiences two growth modes:[27] one is catch-up innovation, which means that the science and technology that promotes growth mainly comes from the outside. Compared with technology-leading countries, less developed countries have backward technology and they aim for growth catch-up. The other is endogenous innovation, where technology innovation comes from internal operations, and it is this science and technology that leads growth. An economic entity characterized by sustainable development must experience transformation from catch-up innovation to endogenous innovation. The former mode grows rapidly, and the latter more slowly.[28] However, only by the successful implementation of innovation transformation can a nation maintain its long-term status of leading the world economy. For example, the United States originally enjoyed catch-up growth, and its GDP

[27]Jeffrey D. Sachs, 2015. *The Age of Sustainable Development*, Columbia University Press (January 20, 2015).

[28]In 1820–1870, the United Kingdom enjoyed endogenous innovation with an average annual GDP growth rate of 2.05%; the United States was engaged in catch-up innovation with an average annual growth rate of 4.20%. In 1950–1973, the United States entered a stage of endogenous innovation with an average growth rate of 3.93%, and Japan was then in catch-up mode with an average growth rate of 9.29%. In 1978–2008, the United States enjoyed an average growth rate of 2.84% with endogenous innovation, and China engaged in catch-up innovation with an average growth rate of 9.92%. Calculating data source: Angus Maddison: *Historical Statistics of the World*: 1-2008 AD, http://www.ggdc.net/maddison/oriindex.htm.

growth was 4.20% in 1820–1870, which was higher the growth rate (2.05%) of the leading country (the United Kingdom). This was then 3.94% in 1870–1913, transforming from catch-up growth to endogenous growth, and 3.11% in 1913–2008,[29] maintaining its leader status in the world economy. Currently, China has had more than 60 years of catch-up development, and therefore must now consciously and purposefully move into a phase of endogenous innovation. It is estimated that it will take approximately 40 years for China to become a development leader.

Regarding the laws of institutional innovation, whether a country can rise ultimately depends on the strength of its institutional innovation. In the last 400 years or so,[30] few big powers have had a truly significant impact on world development, and without exception, the prosperity of these big powers reflects the development laws of the institutional innovation.

Any of these countries can be described as a "great power of scientific and technological innovation" and a "great power of institutional innovation", and their social systems show historical progress and limitations within certain periods and ranges. For example, from the perspective of changing times, capitalism exceeds previous forms of capitalism, and socialism exceeds capitalism. From a national perspective, the United Kingdom exceeds Portugal and Spain, the United States exceeds the United Kingdom, and China is catching up with and will surpass the United States. We acknowledge that capitalism has its own innovation and adjustment mechanisms and takes the lead in industrialization, urbanization, and modernization worldwide. It also has the first-mover advantage, but is increasingly rigid, aging, and has even been "unhealthy' for some time now. Thus, capitalism represents the shackles of economic and social development, and has its own unsolvable crisis and depression, which will cause a significant crisis, mass destruction, and a great recession that could spread worldwide. This has been proved by the successive outbreak of two Asian financial crises and an international financial crisis, all within the last 20 years.

China's current socialist system with Chinese characteristics enjoys advanced features of modern times for two reasons: it has fully absorbed all of the achievements of human civilization development and represents the theoretical innovation, institutional innovation, and path innovation of self-exploration, self-improvement, and self-transcendence present in China's reform practices.

Insisting on innovative development means to develop new productive forces, establish new productive relationships and adapt to them, build a new development system, and to speed up the creation of a market environment conducive to innovative development. It also means to develop a property rights system, investment and financing system, distribution system and employment mechanism. Innovative

[29]Calculating data source: Angus Maddison: *Historical Statistics of the World*: 1-2008 AD, http://www.ggdc.net/maddison/oriindex.htm.

[30]Historians often regard the 16th century as the beginning of modern world history according to the standard of productivity, and modern world history mainly refers to the history of the capitalistic period.

development means to continuously make innovations, improve macroeconomic regulations and controls, and further promote the national governance system, governance ability, and modernization.

2.4 Main Aspects

2016 marked the beginning of the decisive phase in national efforts to ensure China becomes a moderately prosperous society, and it was also the crucial year in which key difficulties were overcome to introduce structural reforms. Therefore, the significance of realizing the 13th Five-Year Plan differs from that in the past. Achieving the goal by 2020 lays an important foundation to realize the century-old national dream and China's dream, representing a new development stage, and lays a new foundation for development. Innovative development is the first impetus for entering a new stage, and lays a new foundation. It also means the continuous promotion of theoretical innovation, system innovation, technological innovation, and cultural innovation, creating first-mover advantages, and realizing world-leading development.

Specifically, the 13th Five-Year Plan period means to base China's economic and social development on innovation-driven development, and to speed up the implementation of the transformation of catch-up innovation to include world-leading innovation. In the important field and crucial link concerning national strategic interests and long-term development, China already has outlines for 2030, and aims to reach dizzying heights by 2050. Furthermore, China will be the master of the dominant right to international competition and possess the right to speak out on international rules. China will possess the key knowledge, strengths, and breakthrough points of innovative development from the core of economic growth. This includes the following aspects:

2.4.1 Strengthening Scientific and Technological Innovation

As Comrade Xi Jinping once commented, "China's innovation capability is not strong, the overall development level of science and technology is not high, science and technology has an insufficient ability to support economic and social development, and the contribution rate of science and technology to economic growth is far lower than the level of developed countries. This is the 'Achilles heel' for China's economy. A new round of scientific and technological revolution brings fiercer science and technology competition. If science and technology innovation cannot keep pace, it will be impossible to realize the transformation of the impetus for development, and we will be at a disadvantageous position in global economic

competition. The ability for science and technological innovation is not only the core competitiveness of an enterprise, but also the core competence for a nation to participate in international competition and global competition."[31] In the field of science and technology innovation, China shall continuously strengthen and simultaneously improve on five major abilities: foundation innovation; original innovation; integrated innovation; introduction, digestion, absorption and re-innovation; and collaborative innovation. Thus, China will promote the efficient allocation and comprehensive integration of all kinds of innovation resources, and use the wisdom and strength of society as a whole to achieve innovative development.

To improve China's ability to engage in science and technology innovation, it is necessary to give play to the "five-in-one" impetuses of foundation innovation, technological innovation, market innovation, brand innovation, and cultural innovation. Foundation innovation is an important platform for fundamental, world leading research on externalities, and it is necessary to speed up the construction of a number of national laboratories of interdisciplinary collaboration around national strategies in significant fields of innovation. Technology innovation should be rooted in the basic advantages of existing industries, and be upgraded to world-class innovation advantages. Furthermore, it should make full use of China's market innovation advantages, reduce the costs of science and technology innovation costs by China's unique economies of scale, and promote the expansion of market innovation by cost advantages. Brand innovation is the most direct standard for checking innovation. To become an innovative country, China is inseparable from the core technologies and independent brands of first-class innovative enterprises. This must encourage innovative enterprises to constantly grow, catch up with and surpass Western world-class enterprises, and constantly create outstanding Chinese brands. Cultural innovation means to advocate the innovation spirit, encourage innovation consciousness, and give play to innovation benefits in society as a whole.

2.4.2 Promoting the Innovation Vitality of Enterprises

"Only when enterprises are strong, can a nation be strong". Without the innovation of enterprises, there would be no innovation of a nation. To become an innovative country, China must be inseparable from innovative companies that constantly grow, and constantly catch up with and surpass Western world-class companies.

It is necessary to build a market-oriented technology innovation system with enterprises as the subjects, and with industry–university research cooperation. Thus, enterprises essentially become the investors of research and development, the

[31]Xi Jinping: *Speech by President Xi Jinping at the 2nd Plenary Meeting of the 5th Plenary Session of the 18th CPC Central Committee (Excerpts)*, *Qiushi*, No. 1, 2016.

subjects of technological innovation activities, and the subjects of the transformation and application of innovative products. China shall not only "relax control over small enterprises" according to negative list management and support the development of technology-based small and medium-sized enterprises, but also "invigorate large enterprises", promote state-owned enterprises to further deepen the reform, break administrative monopolies, and enhance the competitiveness and innovation ability of state-owned enterprises.

2.4.3 The Advantages of Building Industry Innovation

Industry is the mechanism that founds a nation as well as the foundation for strengthening a nation. Industrial innovation is the key to realizing world-leading development. The creation of new industrial advantages requires that faster technology innovation and applications in new fields, and also the ability to upgrade traditional advantages, build a new system, expand new spaces, and encourage industry to March toward high-end outputs.

In terms of innovation in new fields, we have already prepared an outline of China in 2050, cultivated strategic industries in fields such as oceanography, information networks, life science, and nuclear technology, sped up the attainment of goals set for 2030, and formed innovative breakthroughs and applications in key directions such as energy conservation and environmental protection, high-end equipment, and a new version of the Internet. In terms of industrial upgrading, we have promoted traditional industries to improve quality and enhance efficiency mainly around the integration of informatization and industrialization, environmental protection, and energy conservation. In terms of building a new system, we have implemented *Made in China 2025*, and achieved intelligent manufacturing, green manufacturing, and service manufacturing. In terms of expanding into new areas, with Internet Plus, high-speed railways, expressways, nuclear power engineering, UHV power transmission, bridge engineering and water conservancy (i.e., dam construction) representing breakthrough, we are promoting domestic and international connectivity. Thus, we lead the way in terms of the modernization of infrastructure in the first half of the 21st century, and have helped to shape the support for China's innovation.

2.4.4 The Characteristics of Market Innovation

Innovation is an economic activity with very high investments and risks, and is extremely vulnerable to impacts on growth. Therefore, the probability of success is usually small, especially the probability of the realization of business success and market success. However, once the application range of a truly valuable innovation expands from 1 km^2 to millions of km^2, and from a population of hundreds or

thousands to one of billions, then the final average fixed cost of upfront investment is almost zero, thereby greatly reducing the economic cost of science and technology innovation, and the transaction cost of science and technology application. China's huge domestic market will become the "first thrust" of innovation growth.

It is necessary to establish a more unified, convenient, and freely circulating tangible and intangible infrastructure (network) in China, and to guide enterprises to better use this scale advantage. In the initial stage, it is possible to use free trial or inexpensive approaches, and then for enterprises to grow into world-class emerging enterprises. Thus, the market advantages that cannot be possessed by multinational companies are converted into innovation advantages for Chinese enterprises.

2.4.5 *Improving the Mechanism of Institutional Innovation*

Path innovation is the most essential innovation, and is the determinant for realizing all other innovation activities and processes. Promoting innovative development is inseparable from improvements to the following institutional innovation mechanisms: the "two hands" mechanism of the government and market, the "two positive mechanisms" of the central and local governments, the mechanism of "walking on two legs" of state-owned enterprises and private enterprises, and the two-way communication mechanism of "receiving" and "sending".

The measures specifically include the following: improving China's economic decision systems and mechanisms (e.g., the central economic work conference system, the government work report system of the State Council, the five-year plan system for national economic and social development, and all other special plan systems; further developing science and technological system reform, guiding the creating of industrial technology innovation alliances; establishing a diversified societal innovation input mechanism, perfecting a judicial system to protect intellectual property rights; building domestic and international environments for fair competition that stimulate innovation, and establishing a policy environment and social atmosphere that nurtures original innovation, integrated innovation, introduction, digestion, absorption and re-innovation, and collaborative innovation.

2.4.6 *Implementing a Strategy of Innovative Talents*

"Unusual talents must be relied upon to create unusual achievements".[32] Talents are the source of innovations, and top talents are the sources of significant innovations. To achieve innovative development, we must "regard talents as the first resource

[32]Quote comes from *Han Book & Emperor Xiaowu 6th* of Ban Gu.

supporting development",[33] find talents, introduce talents, cultivate talents, and put the use of talents as a key priority in the innovation strategy. We also need to accelerate the implementation of the "four-in-one" talent strategy:

(1) Implement an education strategy that gives priority to education development, and achieve the goal of striding forward, going from a nation with a large education system to a great educational power and from a nation with significant human resources to a great human resource power;
(2) Implement a strategy to reinvigorate China via human resource development. China will enter the ranks of the great talent powers in the world, and will ensure that the education development idea target and the main indicators are meet by 2020.[34] This will highlight the cultivation of innovative talents, create high-end talent for China's innovation-driven development idea, and form various large-scale talent bonuses;
(3) Vigorously promote the construction of a talent team, improve the China's talent use mechanism overall, and promote the construction of talent policy, as well as talents in the areas of enterprise operation and management, professional and technical talents, high-skilled talents, rural talents and social work talents; and
(4) Intensify the introduction of foreign knowledge by expanding exchanges with the outside. By 2020, China aims to realize the goal that talent resources will reach more than 200 million people, and the proportion of the total quantity of talent resources will be enhanced to 20–25%. Furthermore, China hopes to introduce and cultivate a number of academic leaders of a world-class level, attract and build a number of international academic research centers and idea bank research centers, which will lead to significant innovation activities, and fully meet the needs of economic and social development.

2.4.7 Innovative Macroeconomic Regulation and Control

The "imbalance between supply and demand" has become the biggest obstacle to China's sustainable economic growth, and the "supply failure" and "weak demand" are presently the biggest problems. The growth dilemma needs to be solved by striving to strengthen the structural reform of the supply front, as well as attempting

[33]Xi Jinping: *Speech by President Xi Jinping at the 2nd Plenary Meeting of the 5th Plenary Session of the 18th CPC Central Committee (Excerpts)*, *Qiushi*, No. 1, 2016.

[34]By 2020, the overall goal of talent development of China is to cultivate and form large-scale talent teams with optimized structure, reasonable layout, excellent quality, and to establish comparative advantages of national talent competition. Further goals include entering the ranks of the great talent powers in the world, and to lay a talent foundation to realizing socialist modernization by the middle of this century. *National Guideline for Medium- and Long-term Plans for Talent Development* (2010–2020), Xinhua News Agency, June 6, 2010, Beijing.

to increase the quality and efficiency of the supply system whilst moderately expanding aggregate demand.[35] It is necessary to open up new policies on macroeconomic regulation and control, and to create new opportunities for economic growth. This is the updated version for the strategic adjustment of the economic structure, and it needs not only to stimulate the economic tension on the demand front, but also to rebuild the economic thrust of the supply front as follows:

(1) Promote the synchronous development of new industrialization, informationization, new urbanization, agricultural modernization, and infrastructure modernization;
(2) Strengthen the role of the supply front in the transformation of the demand structure, actively adapt to and guide the upgrading of the consumption structure, and improve the effect of consumption on economic growth. Furthermore, it is essential that China strives to ensure that the contribution rate of consumer spending to economic growth will reach 55% in the 13th Five-Year Plan period, optimize the investment structure, and pay attention to investment benefits. It is also important to open up investments, and accelerate the promotion of international trade liberalization, investment liberalization, and service industry facilitation;
(3) Promote the great development of the modern service industry, improving its overall quality and competitiveness; and
(4) Through the reorganization of enterprises by mergers and acquisitions, cultivate enterprise groups with core competitiveness, and effectively solve the problem of excessive production capacity using the market mechanism and economic means.

2.5 Summary

The Fifth Plenary Session of the Eighteenth CPC Central Committee presented the development idea of innovation, coordination, greening, opening-up and sharing. It also prioritized innovation, and emphasized that innovation is the first impetus leading development. Furthermore, the CPC Central Committee stressed that it is necessary to put innovation at the core of national development, reflecting the views of the CPC Central Committee that have centralized the overall situation, keeping pace with the times and a new normal for economic development. From the perspective of the logic of the new development idea, innovative development is the first impetus for revitalizing China, and coordinated development is the art of managing state affairs as a whole. Green development is the core idea of managing state affairs and opening-up development is the only way to revitalizing China.

[35] *Speech by Xi Jinping at the 11th meeting of central finance and economy leading group, the central group stressed to strengthen structural reform of the supply front and control both the demand and supply*, Xinhua News Agency, November 10, 2015, Beijing.

Sharing development is the ultimate goal of managing state affairs and safe development is the basic security of managing state affairs. As the basis of economic and social development, innovation plays an important fundamental and guiding role in realizing development, be it coordinated, green, opening-up, sharing, or safe development.

Innovative development is the key to creating a new normal for economic development, representing the latest achievements of the development concepts of the CPC, and it enriches and develops the new meaning behind the concept of socialist development with Chinese characteristics. It is also the best summary of the practice of managing state affairs and dealing with political affairs by the CPC, as well as the development and sublimation of the concept of ruling for the people and revitalizing China. This will have a significant and far-reaching impact on economic and social reform and development in each field and for each link in China in the future. Ultimately, innovative development will trigger extensive, profound reforms.

Since the founding of new China more than 60 years ago, China has developed from a worldwide power without modern science and technology into a great science and technology power. The relative gap between China's strength in terms of science and technology and that of the United States is rapidly narrowing. China's course of innovative development proves the principle that "a nation will be prosperous if it has advanced science and technology, and a power will be strong if it has advanced science and technology". This sets a good example for those countries with backward science and technology, enabling them to catch up with and surpass countries with more advanced levels.

China, starting out with weak development and a backward infrastructure, has achieved such remarkable innovative development. This is seldom seen in developing countries, but China has earned such success for the reasons outline below.

First, in terms of the development path, the CPC Central Committee found an innovative path that is appropriate for China's national conditions, adapting to the different development stages, and making full use of the superiority of the socialist system, the second-mover advantages of the country, and the competitive advantages of the market economy in continuous exploration.

Second, in terms of the development mode, the CPC Central Committee and the State Council accelerated the development of China's ability for independent innovation with foresighted planning in terms of guidance, by controlling key links, scientific planning, overall planning, close cooperation, and mobilizing all social forces and even global innovation resources. These actions formed the unique advantages of China's innovative development pattern.

Third, in terms of China's development idea, the CPC Central Committee has managed to keep pace with the times, expanded and completed development, gradually deepened development, and ensured the transition from "science and technology constitute one of the productive forces" to an "innovation-driven development idea", and from "science and technology is a primary productive force" to "innovation is the main impetus leading development". This not only reflects China's active understanding of the economic laws of innovative

development, but is also an important cornerstone for following the objective requirements of historical development, and constantly helps China's innovative development to reach new levels and heights.

Fourth, in terms of following innovative development laws, China has gradually attained and repeatedly tested an important mechanism for a country with backward science and technology to achieve its "science and technology catch-up" in the practice of innovative development. Thus, to do so significantly enhances the overall strength of science and technology, and ensures significant gains in the development of science and technology by fostering and introducing science and technology capacity (T1), ensuring a capacity for science and technology re-innovation (including introduction innovation, imitation innovation, and integrated innovation) (T2), strengthening the ability for independent innovation in science and technology (T3), actively triggering the innovation advantages of a country of China's size (T4), and creating an arena of science and technology innovation in the world market (T5).