# Thirty Years of Construction and New Era Development of China' s National High-tech Zones: Postprint Commemorating the 30th Anniversary

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## Abstract

This article summarizes the 30-year developmental trajectory and achievements of national high-tech zones, evaluates and reveals the national role and historical significance of establishing national high-tech zones; conducts an in-depth analysis of the challenges confronting national high-tech zones in the new era and the laws of transformation and development; proposes the development goals and strategic frameworks for the "innovation economy" as the third venture of national high-tech zones, and, integrating with the actual development of high-tech zones, proposes key directions and measures for advancement in the new era.

## Full Text

## Preamble

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### The New Era Development of China' s National High-tech Industrial Development Zones —Commemorating the 30th Anniversary of National High-tech Zone Construction

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This article summarizes the 30-year historical process and developmental achievements of national high-tech industrial development zones, evaluates and reveals their national role and historical significance. It provides an in-depth analysis of the challenges and transformation development patterns faced by national high-tech zones in the new era, proposes the construction goals and approaches for developing an "innovation economy" during the third

entrepreneurship phase, and, based on the actual development of high-tech zones, puts forward key directions and measures for new-era construction.

**Keywords:** high-tech industrial development zones, confidence in path, innovative economic ecology, new technology revolution, intelligent society

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## 2018: The 30th Anniversary and a New Starting Point

2018 marks the 30th anniversary of national high-tech industrial development zone construction in China, as well as the inaugural year for implementing the two-stage national development goals outlined at the 19th National Congress of the Communist Party of China. At this historic juncture, both reviewing the past and looking toward the future are essential. Therefore, this article, drawing upon 30 years of construction practice in national high-tech zones and the goals and missions of national development in the new era, provides a brief overview and reflection on the historical construction process and future transformation development of national high-tech zones, as a commemoration of their 30-year journey.

## The Origins of National High-tech Zones

China' s high-tech zone development history can be traced back to the 1980s. In March 1985, the Central Committee of the Communist Party of China issued the *Decision on the Reform of the Science and Technology System* (hereinafter referred to as the *Decision*). The *Decision* proposed that "to accelerate the development of emerging industries, several regions with concentrated intellectual resources should be selected nationwide to adopt special policies and gradually form emerging industry development zones with different characteristics" [1]. This marked the first time high-tech zones were proposed as a national strategy. Following the release of the *Decision*, from 1986 to 1987, the former State Science and Technology Commission commissioned the former Institute of Science and Technology Policy and Management Science of the Chinese Academy of Sciences (now the "Institute of Science and Technology Strategy and Consulting, Chinese Academy of Sciences") to jointly organize research on establishing high-tech zones in China with multiple academic departments and local governments nationwide—the *Study on China' s High-tech Development Zones*. This study first proposed constructing national high-tech zones in provinces and cities with advantages in intellectual density.

By March 1988, the plan for pioneering the construction of a new technology development experimental zone in the Zhongguancun area, submitted by the former State Science and Technology Commission and the Beijing Municipal Government, was prioritized and approved by the State Council, which issued

its reply to the *Interim Regulations of Beijing New Technology Industry Development Experimental Zone*. This officially launched the history of China' s national high-tech industrial development zone construction and development.

Following the establishment of Zhongguancun High-tech Zone, the State Council 集中 approved a total of 51 national high-tech zones across the country in two batches in 1991 and 1992, forming the initial group construction scale of early national high-tech zones. After 2007, the State Council successively approved new national high-tech zones in different stages and batches nationwide. Particularly after 2012, the State Council further accelerated the pace of approving national high-tech zone construction, causing the ranks and scale of national high-tech zones to continuously expand over the 30 years. To date, the number of national high-tech zones approved for construction by the State Council has reached 169.

## A Development Process Aligned with National Conditions

Looking back over these 30 years, the construction process of national high-tech zones can be roughly divided into three stages [Figure 1: see original paper]. The evolution of national high-tech zones in each of these three stages, whether through incremental reform models or the path of expanding industrial scale before injecting technological connotations, distinctly reflects the interaction and alignment between China' s national high-tech zones and the prevailing national conditions at the time. National high-tech zones are not merely traditional science and technology parks in the conventional sense, but rather exist as composite values pursuing industrial and economic scale development, carrying out innovation, and achieving innovation-driven development [2].

### 1.2.1 First Entrepreneurship Stage (1988-2000)

The first stage, before 2000, is also called the first entrepreneurship stage. This period coincided with the launch of China's reform and opening-up, when the national industrial foundation was weak and high-tech industries were essentially nonexistent—this was the realistic national condition at the time. Consequently, virtually all national high-tech zones followed a "industry-first" development path, rapidly forming park morphology through strong aggregation of industrial enterprises. Therefore, the primary focus of high-tech zone construction during this stage was aggregating production factors, with construction paths mainly centered on creating hard conditions for production (such as "seven connections and one leveling" ) and attracting investment, with the main goal being the rapid formation of an industrial foundation and economic scale. Overall, construction during this stage manifested essentially as "industrial park" or industrial agglomeration zone construction, with both connotation and form primarily exhibiting industrial park characteristics.

### 1.2.2 Second Entrepreneurship Stage (2001-2010)

The second stage encompasses the first decade of the 21st century, known as the second entrepreneurship stage for national high-tech zones. During this period, following the acceleration of China' s reform and opening-up (with China' s accession to the WTO in 2001), the first batch of national high-tech zones had generally established certain economic foundations and industrial strength. However, the rise of the national economy simultaneously placed higher demands on high-tech zone development. Due to the excessive emphasis on investment attraction and industrial enterprise aggregation during the first entrepreneurship stage, the original construction goals of integrating science and technology with the economy, transforming scientific and technological achievements, and achieving endogenous and connotative development in high-tech zones were not fully realized. This also resulted in most high-tech industries in high-tech zones during the first entrepreneurship stage remaining at the low end of the processing and manufacturing value chain, with the prevalent problem being parks that had "bodies" but no "brains."

To address this, in 2001, the Ministry of Science and Technology convened a working meeting in Wuhan, timely proposing the slogan of "second entrepreneurship" for national high-tech zones and emphasizing that the second entrepreneurship should focus on promoting "five transformations" [1]. The core emphasis of the second entrepreneurship stage was injecting technological elements, with technological achievement transformation and technological innovation being the fundamental aspects that high-tech zone development must not deviate from.

Consequently, high-tech zones that had experienced the first entrepreneurship stage generally strengthened their emphasis on technological connotations during the second entrepreneurship stage, including introducing R&D institutions and scientific-educational resources, creating knowledge atmospheres and building innovation platforms in parks, promoting scientific and technological achievement transformation, and constructing incubators. This enabled high-tech zones to truly embark on the development connotation and target positioning of "science and technology industrial parks." Overall, the main goals of the second entrepreneurship for national high-tech zones shifted more toward promoting value chain upgrading of industries and connotation development based on technological innovation. In June 2005, during an inspection of Zhongguancun Science Park, then Premier Wen Jiabao proposed the "four-in-one" development orientation for national high-tech zones [2]. In conjunction with this new development orientation, the Ministry of Science and Technology reconstructed a new evaluation orientation for national high-tech zones in 2007 [3] and comprehensively launched classified guidance work for the "big family" of national high-tech zones undergoing second entrepreneurship [4].

### 1.2.3 Third Entrepreneurship Stage (2011-Present)

The period from 2011 to the present constitutes the third stage of national high-tech zone construction, also known as the third entrepreneurship stage. During this period, major changes have occurred in both international and domestic environments. First, China has become the world' s second-largest economy, facing a development transformation from a large economy to a strong economy. Second, after more than 20 years of development and construction, the number of national high-tech zones, their spatial scope, and economic volume have all expanded dramatically, requiring them to shoulder new missions of leading innovation-driven development. Particularly after the 18th National Congress of the Communist Party of China, innovation has become the foremost among the nation' s five development concepts, with the nature and scope of innovation also changing. General Secretary Xi Jinping specifically pointed out that "innovation is comprehensive innovation with scientific and technological innovation at its core."

These developmental changes have propelled national high-tech zone construction into a new stage of "comprehensive innovation."From the perspective of comprehensive innovation, high-tech zone construction must focus on all elements conducive to innovation, with construction paths dedicated to comprehensively creating environments favorable to innovation and carrying out independent innovation. This has actually prompted high-tech zones to begin a comprehensive transformation toward "innovation economic ecology." Moreover, accompanied by the widespread integration of industry and city in mainstream high-tech zones and their existence as forms of new urban areas (districts), mainstream high-tech zones are increasingly exhibiting characteristics and forms of localized "innovation economies" [5, 6].

## Unprecedented Development Achievements

Looking back at history, if the establishment of national high-tech zones 30 years ago was viewed as a strategy or policy of China' s reform and opening-up, then the implementation effects of this policy have far exceeded the expectations of 30 years ago.

The initial policy goals set for national high-tech zones can be summarized in eight characters: "demonstration, guidance, radiation, and driving"[7]. "Demonstration" means that high-tech zone construction should become a model for promoting science and technology system reform, i.e., promoting close integration of science and technology with the economy within the spatial scope of high-tech zones. "Guidance" means leading the development of China' s high-tech industries through high-tech zone construction. "Radiation" refers to the advanced technologies and knowledge developed in high-tech zones radiating to other industries, particularly focusing on boosting the transformation of traditional industries and upgrading low-end industries against the background of that time. "Driving" means that high-tech zones should drive local economic

development and become growth poles for regional economies. In retrospect, these initially established policy goals have been successfully accomplished.

Based on 2017 statistics, the combined gross product of the 156 national high-tech zones participating in statistics that year reached 9.52 trillion RMB, equivalent to 11.5% of the nation' s GDP (8.271 trillion RMB) for that year. From the perspective of innovation, in 2017, the ratio of R&D expenditure by enterprises in the 156 high-tech zones to gross product was 7.09%, 3.3 times the ratio of national R&D expenditure to GDP. From the perspective of innovation performance, in 2017, the number of invention patent applications granted in the 156 high-tech zones accounted for 20.8% of the national total; the number of invention patents granted and valid invention patents per 10,000 employees was more than 10 times the national average. From the perspective of innovation entity development, in 2017, the 156 national high-tech zones housed 52,000 high-tech enterprises, accounting for 38.2% of the national total; 386,000 new enterprises were registered that year, averaging 1,058 per day. From the perspective of leading industrial structure adjustment and developing emerging industries, currently most of the nation' s strategic emerging industries are concentrated in high-tech zones, and 96 of the top 100 Internet companies in China are located in high-tech zones.

Through policy performance evaluation, we can see that 30 years of national high-tech zone construction has not only successfully accomplished the policy goals of "demonstration, guidance, radiation, and driving," but also generated policy spillover effects beyond expectations. Today' s high-tech zones have become the main force and main battlefield for promoting national innovation development. Moreover, in various localities, national high-tech zones have mostly become organic components of new cities (districts), and the innovation-driven development practices of high-tech zones are becoming pioneers leading the construction of innovative cities and an innovative country.

## National and Historical Significance of National High-tech Zone Construction

### 1.4.1 Confidence in Path

Reviewing 2,000 years of Chinese history, large-scale social reforms have only succeeded under the leadership of the Communist Party of China in socialist China. This success is attributable to the "reform + opening-up"path established at the beginning of reform—i.e., it is not merely "inward-looking" reform, but a dual-wheel drive of "reform + opening-up." Precedents of successful large-scale "inward-looking" social reforms are rare in Chinese history, from Shang Yang' s reforms to Wang Anshi' s reforms, all ultimately ending in failure. This is because purely "inward-looking" reforms lack reference targets on one hand, and cannot "borrow momentum" or "leverage strength" on the other, resulting in situations where even if "stones are touched," the "river" cannot be crossed, or the opposite bank of the "river" remains unknown.

The construction practice of national high-tech zones vividly illustrates the success of China' s "reform + opening-up" path. First, through reforms in the science and technology system and economic system in high-tech zones, the enthusiasm of domestic intellectual groups and private forces to participate in park construction was greatly mobilized. Reforms continuously removed constraints in systems, concepts, and relationships, creating encouraged and undisturbed niches that fully released folk wisdom and effectively played and developed the role of "talent." Meanwhile, the "opening-up" practices of high-tech zones, from emulating world-class park development experiences, introducing advanced technologies and enterprises, and leveraging global open markets, to integrating global innovation resources, establishing targets, and absorbing nutrients, truly practiced "learning from others' strengths." The combined boost of releasing national wisdom and opening-up borrowing has achieved the development of China' s high-tech zones to date, which has also become the main reason why China' s national high-tech zones have surpassed the vast majority of science and technology parks worldwide in just 30 years.

### 1.4.2 Confidence in System

Unlike science and technology parks in Western countries such as the United States that are market-dominated, China' s national high-tech zone construction is government-led. Comparisons show many precedents of unsuccessful or slow development of government-led science and technology parks, and even for spontaneously generated market-based science and technology parks, currently, apart from Silicon Valley in the United States, few can match the development achievements of China's national high-tech zones. This means China's high-tech zone development path has its uniqueness, which reflects institutional differences behind the path. It can be argued that the most fundamental reason for the rise of China' s national high-tech zones in the world is the strong support provided by China' s specific institutional environment and new government-business relations.

Generally, government-business relations under Western systems embody the principle of "render unto Caesar the things that are Caesar' s, and unto God the things that are God' s," i.e., the government only does regulatory governance, while the market has its spontaneity and freedom of choice. However, China' s high-tech zone construction does not follow this logic. China' s logic is that the government designates a specific urban spatial area, establishes special government functional organizations (such as management committees and other dispatched agencies) in this area, builds or organizes integrated resource platforms for the market and implements specific promotion policies, with these resources and policies being completely injected as elements or nutrients into the economic operation of market or commercial departments. This is not "render unto Caesar the things that are Caesar' s, and unto God the things that are God' s," but rather "the government builds the stage, and the market performs on it." Such institutional and mechanism design does not completely fall into the

predicament of government interfering with the market or competing with it for profits, nor does it fall into the trap of market failure in integrating development resources due to the blindness of free choice and economic entities.

This is a new type of government-business relationship. That "we can do what others cannot do or cannot achieve" essentially reflects confidence in the socialist system with Chinese characteristics. Because the socialist system ensures that everything the government does is for the people, the purpose of government planning, platform building, and resource integration is all for the "people" and used for the "people" —in the context of high-tech zones, this means for the "market" or business organizations. This not only reflects China's institutional "characteristics," but also establishes the rationality and legitimacy of the management system and operation model of high-tech zones at the principle level. Thus, China's national high-tech zone construction is also an institutional innovation with Chinese characteristics, different from both its old system and foreign "conventions." In terms of seeking economic development paths, the creation of this "new government-business relationship" provides a referenceable example for late-developing countries' path choices and the establishment of open competition rules for government-business relations.

### 1.4.3 Confidence in Theory

Theoretically, this "new government-business relationship" can be considered a design of "embedded" social institutions, which enriches and expands government behavior theory, political economy theory, and sociology theory. Regarding "embeddedness" theory, Polanyi [8], Granovetter [9], Uzzi [10, 11], Barber [12], and Lee et al. [13] have all provided comprehensive discussions from the perspective of economic and social relations, but few have revealed or explained government "embeddedness." However, in fact, in human civilizations throughout history and in governments and societies under any system, government "embeddedness" in national economic relations, social relations, and the interactive relations between economy and society is ubiquitous, not merely manifested as government "shaping" these "relations." Moreover, with the increasing complexity of economic and social relations and the networked social development trend brought by technological revolutions such as the Internet, big data, and artificial intelligence, the existence of "structural holes" [14] has become more widespread, and these "structural holes" increasingly influence the operation status and efficiency of economic and social systems. To enhance the operational efficiency and competitiveness of a country's economic system, repairing those critical "structural holes" is necessary for system optimization, and the only actor that can play the key "repairing" role is the government. Therefore, in economic competitive development, the existence of modern national or regional governments is essential, and governments need to conduct "structural" and "behavioral" embedding.

What kind of "embedding" and how to "embed" are questions that China's national high-tech zone construction has made meaningful practical explorations

on, and the results have proven that such explorations can better or more effectively support the operation of national, regional, and even private sector economic systems. For example, the management committee, a functional government dispatched agency design; various element aggregation platforms and innovation and entrepreneurship incubation platforms built by the government; and technology cooperation and resource cooperation networks built by the government or its affiliated institutions are all effective "structural embedding" of the government into the economic system. Meanwhile, government-led or participated investment attraction, talent recruitment, and resource integration activities in high-tech zones typically present as "behavioral embedding" of the government into the economic system. Government "structural embedding" can more effectively fit the "structural holes" that objectively exist in the market' s resource integration, while government "behavioral embedding" can effectively correct the blindness of free markets and "market failures" caused by information asymmetry.

This provides a new sample for the boundaries and roles of government under market economy conditions, and its practices and explorations continuously enrich the research content of economics and government behavior theory.

### 1.4.4 Confidence in Culture

Finally, we must mention the "cultural confidence" reflected in the brief development history of national high-tech zones. The Chinese nation generally originated from "farming" peoples or inherited "farming" civilization, and there are inherent differences in cultural accumulation from "nomadic" peoples and "maritime plundering" peoples. Such differences are often simply interpreted as the Chinese nation lacking pioneering spirit and innovative spirit. However, from the 30-year striving history of national high-tech zones, we can see the bias in this interpretation. In fact, farming peoples, due to the frequent need to face natural and man-made disasters, are genetically endowed with a sense of "anxiety" in their national character. Because of this "anxiety," they must be "diligent," must quickly adapt to changes and "advance with the times," which has shaped the unyielding spiritual temperament and innovative spirit of the Chinese nation.

It is not difficult to see that throughout the 30-year construction process of national high-tech zones, the "anxiety" consciousness, "diligence" quality, the self-improvement spirit of "not willing to lag behind" and "daring to be the first," as well as the ideal creed of "national sentiment" and "benefiting the local area" have always supported the struggle and advancement of high-tech zone builders. This has led to continuously elevated construction target requirements and policy orientations from high-tech zone decision-makers or government departments over the 30 years, the 追赶比、学、赶、超 (comparing, learning, catching up, and surpassing) among local construction entities of high-tech zones, as well as breakthroughs in systems, mechanisms, and policies, and the unremitting pursuit of product, organizational, and model innovations by frontline builders

(various organizations and individuals in production, education, research, capital, intermediation, and application). Consequently, there has been continuous improvement in the innovation environment through persistent cultivation, which in turn has attracted and aggregated more resources and more prosperous entrepreneurship. All these have forged the ever-increasing innovation capacity and vitality of national high-tech zones, reflecting the "innovation" and striving spirit rooted in the "cultural" soil of the Chinese nation.

The rapid rise of China's national high-tech zones over 30 years is increasingly filling in the "cultural confidence" of the Chinese nation against the background of multicultural integration in globalization.

## New Challenges and New Thinking

### The Challenge Context

The 19th National Congress proposed China's national development goals for 2035 and 2050, with the fundamental point of achieving these two goals being innovation. As the main force and main battlefield for innovation-driven development, national high-tech zones need to shoulder new missions of leading development and supporting development in China's new era. These are the new requirements proposed by the state for high-tech zone construction in the new era.

Compared with the past 30 years, high-tech zone construction in the new era faces newer and greater challenges. First, after 30 years of high-speed development, high-tech zones, like the national economy under the new normal, face problems such as saturated traditional demand space, increased resource and environmental constraints, and insufficient new growth drivers. Second, global economic competition relations face more severe situations, and China's economic and industrial development will encounter increasing containment from competitors. More importantly, the global technological-economic paradigm is at a juncture of old-new alternation, with new development paths and models having no precedents to follow. Both China's new normal economic development and the reshaping of new global economic relations are situated within this new development scenario or new technological-economic paradigm. These are all major propositions that new-era high-tech zone construction must solve.

### New Productive Forces and Relations of Production

Generally speaking, the new development scenario or new technological-economic paradigm mainly manifests as the arrival of an intelligent society. Japan's *2016 Science and Technology White Paper* divides human society into five stages from the perspective of civilization evolution: hunting society, farming society, industrial society, information society, and intelligent society. We are now in the transition stage from information society civilization to intelligent society civilization [15].

These transformations and stage divisions are essentially triggered by changes in society' s general production technology conditions. The general condition marking the intelligent society is digital and intelligent technology. Currently, we have seen the emergence of new information technology and 4G, 5G and other communication technologies; Internet, Internet of Things, blockchain and other network technologies; cloud computing, big data, storage and other data processing technologies; and AI, VR, AR and other intelligent implementation and scene construction technologies—digital and intelligent new technologies are emerging explosively and have already entered or are entering social production and social life activities as new general conditions, bringing comprehensive changes to product forms, production methods, economic models, and social relations.

In fact, since 2012, we have already fully felt the various changes triggered by these technological advancements, and as far as the current situation is concerned, these changes are only in their initial stage. More drastic impacts and changes on economic and social life are yet to come.

From the interpretation of Marxist theory, the development of intelligent society is reshaping the contradiction deduction between productive forces and relations of production in Marxism. The *Communist Manifesto* proposed that "workers of the world, unite to break the chains on your bodies" [16]. In the industrial economy era, these chains were the bondage of tools on people and the organizational bondage formed by capital' s ownership of tools on people. The development of intelligent technology greatly reduces the bondage of labor tools on people, thereby weakening the organizational bondage of capital on people, which naturally forms the freedom of people released by the development of productive forces. Therefore, "breaking the chains on your bodies" is being realized through the power of technological revolution, and the current technological revolution is becoming a force replacing political revolution. Free individuals can also form social willful unions through ubiquitous networks, with individual "will" and individual "demand" increasingly expressed and satisfied through networks. Scenarios of sharing resources and sharing value are accelerating and expanding, which to some extent 变相 (indirectly) realizes the vision of "workers" uniting to achieve "from each according to his ability" and "to each according to his needs (allocation)."

The development of productive forces in the intelligent era will inevitably "shape" new relations of production. On the one hand, intelligent technology boosts individuals to have more freedom to choose to realize individual value. On the other hand, the "sharing economy" and "sharing models" boosted by intelligent technology also reduce the importance and satisfaction individuals need to have from material wealth. Because most individual needs can be realized through networks at lower cost and more conveniently, the dominating power of private-property "capital" over society is reduced, which necessarily leads to changes in relations of production. From the signs observable currently, the trend of change is increasingly approaching rather than deviating from "communism" —

from each according to his ability, to each according to his needs—thus aligning more closely with the laws of human social operation revealed by Marx.

### The Logic and Laws of New Era Economic Development

We can reveal the logic and laws of new era economic development by following these logical threads:

(1) Internet and intelligent technologies have formed new general production conditions. Changes in society' s general production conditions are of 颠覆 (subversive) significance. In terms of economics, the essence of the Internet is changing "information asymmetry." This has subverted the basic assumptions and prerequisite conditions of traditional economics and real economic laws. Previously, the entire industrial system and economic and trade relations established in the industrial economy era (including traditional companies, factories, shopping malls, logistics and other production and economic organizations) were essentially based on the existence of "information asymmetry" as a basic premise. Under information symmetry scenarios, the prerequisite conditions for the existence of these economic relations collapse, and new production forms and business models can be established entirely anew, such as platform economy, networked collaborative production, B2B, B2C and other new business forms and models we see today. Intelligence is even alienating or reshaping the research objects and boundaries of economics, because essentially intelligence brings value creation and value realization that is non-human or not through human means. "Machines" participate in value creation for humans, which brings the problem that economic organizations must not only "organize people" but also "organize machines." Even the organization of people is organizing those "people" embedded in intelligent production systems. Although it is still difficult to give deterministic cognition to these new "organizations" and "relations," they will certainly bring new changes to future social wealth creation forms, value distribution forms, and production and operation models.

(2) Under new general production conditions, knowledge, wisdom, and data have risen to become new key production elements. In the industrial economy era, social wealth or value was mainly generated by material resources such as labor, machinery, equipment, and factory buildings, so the key production elements in economic development were labor, capital, and land and other material resources. However, in the new economy era, traditional consumption demands are basically satisfied, and new consumption categories and wealth forms need to be realized at higher levels. These new categories and forms all require new elements or come from innovation activities, making knowledge, wisdom (entrepreneurship), and data increasingly the main forms of wealth increase and new economic growth. Consequently, knowledge, wisdom, and data have risen to become key production elements. Knowledge, wisdom, and data becoming key production

elements will inevitably bring changes to the basic laws of economic operation. For example: previously, labor, capital, and land and other material resources are limited. With their input and use in the production process, they generally exhibit the law of increasing marginal cost and diminishing marginal utility [17]. In contrast, knowledge, wisdom, and data, as key production elements, are unlimited and have the characteristic of being used more and more in innovation and new production processes, which presents a completely reverse law to economic theories about production element input costs and utility.

(3) The use of new key production elements brings new "production methods." Such production methods specifically manifest as broad-spectrum innovation, a higher degree of "Internet+" processes, and intelligent value creation and realization. This actually means that new production methods are mainly manifested as engaging in innovation and entrepreneurship and relying on knowledge and data to support products and services.

(4) New "production methods" determine the dependency modes of wealth increase and economic growth, with the role of "scope economy" [18] significantly increasing. In the past, a city or region' s economic growth mainly relied on one or several leading industries, with economic development boosted by the scale expansion and volume expansion of leading industries, bringing population increase and promoting urban expansion. However, the new economic era (production conditions and market conditions) makes it impossible for any mature leading industry to expand infinitely—i.e., there is scale lock. This leads to the force supporting urban economic growth having to rely on continuously expanding new business forms and new economies. The process of wealth increase depends more on the economic diversity brought by innovation and entrepreneurship. This diversified business expansion belongs to the category of "scope economy," meaning that the dependency mode of economic growth has shifted from few-dimensional scale economy to multi-dimensional "scope economy." The importance of the "long tail" [19] increasingly surpasses "scale." The growth of the service economy we see now demonstrates such a trend.

(5) "Scope economy" manifests more as "ecological" composition, and the source and manifestation of multi-dimensional "scope economy" is innovation and entrepreneurship. The broad, diverse, and frequent nature of innovation and entrepreneurship itself is an "ecological" phenomenon of economy and society, and is also stimulated and nurtured by the "ecology." Especially against the background of the new era, driven by technological conditions such as the Internet and intelligence, the self-organization, self-growth, aggressiveness, evolution, and mutation of economic ecology are faster and more explicit. Internet and intelligent technologies strengthen the influence and connections among the constituent elements of the social-economic system ecology, pushing ecological evolution into a "rapid change" stage and causing the "scope" of the innovation economy

to expand rapidly. The innovation ecology in the new economic era is different from the "circular flow" of economy in the industrial economy era. Breaking the "circular flow," innovation and development changes are happening all the time. This also indicates that we can no longer continue to treat Kondratieff's discovered "long waves" as eternal laws [20]. Kondratieff's "long wave" theory is a summary of the cyclical laws of past industrial economies, i.e., approximately every 60 years a new economic cycle would be experienced, with each cycle triggered by a short-term wave of technological innovation. In the new economic era, technological innovations triggering economic changes are occurring continuously. The cycle of transformation where new technologies bring the economy into new states or new cycles has greatly shortened. As we have seen, since the computer revolution, from the Internet economy to the artificial intelligence economy, clear economic cycles can hardly be distinguished. Innovation is deeply integrated into the daily activities of contemporary economy, and every moment of the economy is experiencing "circulation" broken by innovation. This shows that the economic performance of the new era is the connotation manifestation of "innovation economic ecology," where innovation instantaneously brings growth and development, and growth and development instantaneously require innovation.

(6) Under new technological-economic conditions, economic competition between cities and regions mainly manifests as competition of innovation economic ecology. The quality of "innovation economic ecology" determines the competitive advantage level between regions and cities in the new economic era, which is significantly different from competitiveness determined by plate-based scale economy in the past. The development and evolution of innovation economic ecology fundamentally depend on diversified innovation and broad entrepreneurship. Innovation and entrepreneurship induce ecological evolution. Faster and better evolution derives larger, broader, and more diverse economic "scope," enabling the capture of more nutrients and resources, winning greater advantages over others, which further nurtures and strengthens the "ecology," forming a virtuous cycle of "the strong remain strong" in the ecological sense. This brings about the necessity for transformation in regional and urban development thinking and concepts, i.e., shifting from past reliance on natural endowment "comparative advantage" or industry-scale-based "competitive advantage" to creating "innovative ecology" competitive advantage. This can also be considered as the advancing with the times of "competitive advantage" theory [21].

## New Goals and New Explorations

### New Goals and Directions

After 30 years of construction and development, China's national high-tech zones have undergone qualitative changes. Currently, mainstream national high-tech zones have begun developing toward localized "innovation economies," especially those that have experienced the first and second entrepreneurship stages. Moreover, the strategic missions of national development in the new era and profound changes in the macroeconomic background of the new period also require national high-tech zones to integrate into cities with the posture of an "innovation economy" and undertake the mission of supporting urban economic development. Therefore, in the third entrepreneurship stage, mainstream national high-tech zones, especially those that have entered the third entrepreneurship stage, need to target the construction of an "innovation economy" as the basic positioning for new-era national high-tech zone construction. Such positioning also embodies General Secretary Xi Jinping' s emphasis that innovation-driven development is "comprehensive innovation with scientific and technological innovation at its core."

### The Connotation of "Innovation Economy"

In essence, an "innovation economy" is an ecological composition of the innovation economy, representing the mature and developed manifestation of high-tech zones' "innovation economic ecology." Innovation economic ecology can be roughly divided according to five basic aspects as constituent elements: innovation and entrepreneurship, industry, market, society, and urban area (environment). The role of government is to create conditions and introduce policies to promote the development of these five constituent elements and their interactive development. The five basic constituent elements plus policy elements constitute the six-element model of park innovation ecology in the general sense [Figure 2: see original paper].

(1) **Innovation and Entrepreneurship.** The most core element is innovation and entrepreneurship. Innovation and entrepreneurship are the power source for park development. Only continuous innovation and entrepreneurship can support the continuous development and evolution of the park' s innovation economic ecology. The vitality of innovation and entrepreneurship is also a sign of the prosperity of the park' s innovation economic ecology.

(2) **Industry.** Industry is the foundation of the economic ecology and the reason for the park' s existence. Industry drives park development. Whether industry can continuously develop toward high-end goals and form sustained driving force marks whether the park' s economic ecology can become increasingly strong. Industry moving toward high-end development cannot be separated from innovation and also achieves innovation. Without continuous industry development and mutual promotion of innovation

and entrepreneurship, the park' s wealth creation capacity will solidify, leading to the decline of the park' s "ecology."

(3) **Market.** The market relates to the absorption and expansion capacity of the "ecology." The market can absorb populations, gather production and innovation resource elements, enable parks to respond to development changes, and lead innovation trends. However, in the early stages of various development zones in China, due to small spatial scale and economic volume, market issues were often not given much attention. In the new stage, the content and boundaries of national high-tech zones have expanded sufficiently, and the development of park ecology is increasingly influenced by market factors. Especially under the new technological-economic paradigm, markets for knowledge, capital, talent and other innovation elements directly relate to park prosperity or decline. Moreover, the popularization of technologies such as the Internet and big data makes market construction no longer limited by specific location conditions. Transaction scenarios, transaction methods, and transaction behaviors can be carried out without physical space constraints, providing diversified means and methods for market construction in new-stage high-tech zones. Particularly the knowledge market, promoting the exchange and transaction of knowledge and technology, the exchange and transaction of talent, and the power transaction of capital-condensed knowledge through knowledge transaction markets is the most important aspect of high-tech zone market construction in the new era. High-tech zones need to create knowledge markets to promote the aggregation of knowledge, technology, talent, new knowledge groups, and new consumer populations, enhancing the ability of high-tech zones to respond to changes, create changes, and lead changes.

(4) **Society.** In the new era, high-tech zone construction has been deeply integrated into urban social life, and the development transformation of the new technological-economic paradigm has also brought about the socialization of innovation. This makes the knowledge level of park society members, the spiritual temperament of social groups, social knowledge exchange networks, and innovation personal connections all have crucial impacts on forming rooted innovation ecology. Especially with accelerated replacement of old and new knowledge and technology, the ecological vitality and responsiveness to change of parks require park society to continuously enhance its own knowledge and cultural level. Regarding the old-new paradigm alternation facing parks, at the current stage, it is especially important to accelerate the aggregation of new knowledge populations in parks, inject fresh blood, and inject capabilities and vitality to respond to new changes into parks.

(5) **Urban Area (Environment).** The park' s urbanization conditions and environment are the support for the "ecology." To create competitive advantages in the park' s innovation ecology, it is necessary to build its own

urbanization environment well, including natural environment, artificial environment, and public service soft environment. Such environmental advantages directly form external sensory experiences of the park' s innovation economic ecology, which is crucial for talent aggregation in the new era. Therefore, creating a good innovation economic ecology inevitably requires planning parks well, building parks well, and managing parks well.

**New Exploratory Initiatives**

Focusing on the connotation construction of innovation economic ecology and the target development of an "innovation economy," the "third entrepreneurship"of national high-tech zones has many construction contents and exploratory directions different from the "first entrepreneurship" and "second entrepreneurship." These new exploratory practices also represent whether high-tech zones can continue to become pioneers and leaders in the national innovation-driven development path in the new era.

**3.3.1 Platform-based Organization Construction for Innovation and Entrepreneurship and Science and Technology System Reform** In recent years, represented by new R&D institutions and maker spaces, various national high-tech zones have developed diverse platform-based organizations for innovation and entrepreneurship (dual-creation platforms). This platform-based organization for innovation and entrepreneurship is an emerging phenomenon and a manifestation of science and technology organizations and innovation models responding to the new technological-economic paradigm. Its organizational form demonstrates important evolutionary directions for science and technology system reform in the new era and has significance for advancing national science and technology system reform.

Regarding the national innovation system, platform-based and networked organizational structures are the trend from basic research to applied research and then to real-world innovation and entrepreneurship scenarios. In recent years, focusing on the construction of a new-era national innovation system, China has also begun exploring this construction direction in both basic research and applied research fields. For example, the construction of national laboratories in basic research and the construction of national industrial technology innovation centers in applied research both reflect the trend of platformization and networking. The high-quality development of new dual-creation platforms in high-tech zones not only pioneers and leads this new organizational model transformation but also extends the national innovation system to the local "terminal" nerves in real-world economic activity scenarios. Looking forward, cross-boundary integration of basic research, applied research, and innovation and entrepreneurship will be a new focus for national innovation system construction. Thus, the construction of a new national innovation system requires new designs adapted to the times at the "basic layer," "architecture layer," and "experience layer." If we

view the construction of new-era national laboratories and national industrial technology innovation centers as new manifestations of the national innovation system at the "basic layer" and "architecture layer," respectively, then high-quality dual-creation platforms in real-world economic activity scenarios should become the "experience layer" component of the national innovation system. Together, these three components will form the construction 引领 (leadership) of the new-era national innovation system.

From this perspective, new-era high-tech zone construction needs to vigorously develop new dual-creation platforms. However, it must also be acknowledged that after the previous years of governments at all levels promoting the birth and growth of various dual-creation platforms, new dual-creation platforms in high-tech zones also need high-quality construction. In practice, the important aspect of constructing high-quality dual-creation platforms at the current stage is to emphasize the "four-in-one" platform organizational function: an open space scenario that absorbs global innovation and entrepreneurship talent; resource linking and condition configuration built for scientific research and innovation processes; integrated services that reflect high-end enabling capabilities; and financial support or innovation investment to meet the needs of innovators and entrepreneurs to start new ventures. The development of Internet and intelligent technologies provides diversified implementation forms for the construction of "four-in-one" dual-creation platforms, and the high-quality development of dual-creation platforms is also a necessity for high-tech zones to seek competitive advantages in the face of new competition.

**3.3.2 Digitalization, Intelligence, and High-quality Industrial Development** The greatest contribution of national high-tech zones to the national economy over the past 30 years has been helping China form the world' s largest and most complete industrial system, enabling the country to rapidly catch up with the pace of global industrial development and thereby powerfully enhancing national economic competitiveness. Currently, the industrial transformation brought by the new technological revolution is unfolding comprehensively. Regarding the national mission of building an innovation powerhouse, the industrial development of high-tech zones is no longer simply about pursuing scale and systematic advantages, but rather about accelerating the shaping of new advantages and forming global competitiveness in the digital and intelligent economic era. Therefore, the focus of high-quality industrial development in national high-tech zones in the new era cannot be limited to improving product quality and scale quality, but more importantly must develop new industries and upgrade existing industries' production methods. Three keywords are key: new drivers, emerging industries, and new production methods.

(1) **New Drivers.** In the new era, new drivers mainly come from new technologies, most centrally those digital and intelligent technologies that are currently bringing industrial transformation. These digital and intelligent technologies that have already triggered or are triggering transformation

are mainly: new IT technologies, with the 5G era of mobile communication already arriving; Internet, Internet of Things, and blockchain technologies; cloud computing, big data, and storage technologies; and AR, VR, and artificial intelligence technologies. These technologies are partly physics-based, manifested as hardware material products; partly mathematics-based, manifested as software digital products; and more are physics-mathematics hybrids. Currently, these technologies are entering social production and social life activities as new general production conditions. These transformations elevate human production activities to new levels. Against this background, the core of industrial development is to use these digital and intelligent technologies as new drivers and to expand new spaces. Moreover, these technologies themselves are the fields and scenarios of industrial competition in the new era, and their widespread diffusion and penetration elevate past industries and production activities to new levels.

(2) **Emerging Industries.** Understanding new technologies makes it easy to understand emerging industries. Overall, the first impact of new industrial transformation is the new industrial space expanded by digital and intelligent technologies. From current development, we can see that new digital and intelligent technologies can generally expand into four new industrial scopes, simply put: hardware, software, content, and services: hardware refers to new hard-tech products based on physical science; software mainly refers to new digital technology products based on mathematics; content mainly refers to the digital or data representation of economic activities under new technological conditions; and services mainly refer to related applications and services derived from these new technologies. If we must distinguish between strategic emerging industries and emerging industries, then generally speaking, the above four categories can all be broadly called emerging industries, which are also the largest-scale and fastest-developing emerging industries in the new era. The above "hardware" and "software" are the most important strategic emerging industries because they can be used as intermediate goods and infrastructure, while "content" and "service" are emerging industries in the narrow sense because these two industries are mainly used to meet end-consumer demands. Developing emerging industries and strategic emerging industries is the current focus of international competition and the key to whether the nation can win the future in the evolution of the global economic pattern. This is a priority task that national high-tech zones must strongly promote in the new era. National high-tech zones must lead China' s emerging industry development by especially focusing on developing these industries based on digital and intelligent technologies.

(3) **New Production Methods.** The issue of new production methods is also an issue of industrial transformation and upgrading. The new technological revolution is bringing about a complete transformation of industrial production methods. In essence, the trend of this transformation is: the

production of material products shifts from production in the industrial economy era where labor was attached to machines to data-driven production and non-human intelligent production in the new economy era, with production methods undergoing major transformation. Therefore, the current issue of transformation and upgrading of manufacturing industries also becomes the issue of whether digital and intelligent production methods can be rapidly established. Currently, the widely advocated "Internet+" and "Industry 4.0" are driving in this direction. Regarding the current development status of national high-tech zones, manufacturing enterprises that constitute the main body of park economy are still far from such transformation. The common view in the industry is that most Chinese manufacturing enterprises are still at the "Industry 2.0" stage, basically remaining in empirical production or rule-based production where labor is attached to machines. Many large manufacturing enterprises or well-known leading enterprises investigated by the author have still not completed digitalization of production processes and techniques to this day. Without "digitalization," there can be no talk of "Internet+," let alone achieving "Industry 4.0." Therefore, under the general trend of transformation toward intelligent production, the current priority for transformation and upgrading of manufacturing enterprises in high-tech zones is to promote the "digitalization" of production and manufacturing processes, laying the foundation for subsequently carrying out substantive "Internet+" and "Industry 4.0." Recently, the Ministry of Industry and Information Technology issued the *Implementation Plan for Industrial Internet APP Cultivation Project* with this very intention. Therefore, the high-quality development of traditional industrial enterprises in high-tech zones also cannot be separated from the new driver of digital and intelligent technology. Only when park industries complete the entire process transformation from "digitalization" to "Internet+" and then to "Industry 4.0" can they form the digital platform advantages of park industrial development and create competitive advantages of industrial ecology in the new era background.

**3.3.3 Developing New Education and Building Vibrant Communities**

So-called new education refers to emerging experiential education combined with entrepreneurship and careers. The future development of national high-tech zones should make building high-tech zones into new education and talent aggregation gardens an important construction topic.

With the widespread popularization of information and Internet technologies, the ways and means of imparting and receiving knowledge have undergone fundamental changes. Scenes and conditions for "education for knowledge' s sake" can occur and develop almost anytime and anywhere, which has led to the widespread rise of socialized new experiential education [22]. This new experiential education focuses on "cultivating people who can solve problems." Such education and training, as it increasingly meets the needs of updating knowledge

throughout careers in the new era, has triggered widespread participation from global traditional educational institutions, social forces, and industrial organizations. Currently, world-renowned companies such as Google, Microsoft, and Alibaba are all developing such institutions; France' s programming school "42" and top international universities such as Stanford University are also exploring and making efforts in this teaching direction; many such educational institutions have also emerged in China' s high-tech zones, such as Chongqing' s Internet College, which is a new talent education and training form participated in by both government and social forces. This new talent training method and education method largely reflects the trend of education philosophy and education model reform in the new era, and will ultimately trigger comprehensive reform of global education systems and talent training methods.

There are three reasons why China' s national high-tech zones should vigorously develop such training institutions and education forms: Entering the knowledge economy era, knowledge renewal and capability building accompany people throughout their lives. When simple labor is replaced by artificial functions on a large scale, to be competent for work, continuous lifelong knowledge supplementation is necessary. When continuous progressive knowledge supplementation becomes a necessity for careers, training and education under the new situation will inevitably become the largest economic or industrial category in the new era scenario. New experiential training and education are closely related to innovation and entrepreneurship. Experiential training and education are actually experiences and preparations for entrepreneurship and employment, and for dual-creation platforms to function, training and education for entrepreneurs are also crucial. This makes the development of new experiential training and education institutions highly consistent and complementary with the development of innovation and entrepreneurship platforms (new R&D institutions, maker spaces, etc.) in terms of target attributes and functional attributes. New education and training themselves are also a platform-based form of enhancing entrepreneurship. Their organic combination with high-tech zone dual-creation platforms will more expansively promote innovation and entrepreneurship in parks.

More importantly, the vigorous development of experiential education and training by national high-tech zones can absorb generations of new knowledge groups. The mobility and local retention of these knowledge groups can improve the population structure and knowledge level of indigenous residents, continuously injecting new vitality into parks. Moreover, new experiential training and education themselves are a new industrial category and new economic form. Their development and expansion will greatly promote the scope economy of parks. In a deeper sense, developing experiential training and education in high-tech zones is also providing 先行 (pioneering) exploration and experimental demonstration for China' s education models and education system reform.

**3.3.4 Creating Leading Markets and Developing Knowledge Trading**
In the new era, new technology conditions such as Internet and big data provide multiple pathways and diversified implementation methods for economic and trade transactions and market transactions. New-era high-tech zone construction should regard creating leading markets under new-era scenarios as one of the key tasks in building an innovation economy. Especially under the new technological-economic paradigm, the status of innovation elements such as knowledge, capital, and talent in global economic and trade relations has significantly risen. This is the inevitable trend of knowledge economy development. National high-tech zones need to develop market environments that promote the growth of the knowledge economy in the future, which is extremely important for condensing capital, condensing knowledge, and condensing talent. This is a necessary measure to enhance the advantageous position of high-tech zones in innovation development and a marker of whether the goal of building an innovation powerhouse can be achieved.

To create leading markets, high-tech zones must first develop transaction markets and trading platforms based on the Internet, promoting market transactions of goods, elements, property rights, and capital, including: combining transaction market and trading platform construction to promote the development of local warehousing, logistics, and services that combine online and offline; developing commerce and trade markets that combine offline and online, as these circulation industries will enhance local economic vitality; promoting communication and exchange of ideas, concepts, and new development trends through forums, competitions, and exhibitions to enhance the local ability to respond to changes and lead changes.

Particular emphasis should be placed on developing knowledge transaction markets under new-era scenarios. Over the past 30 years, national high-tech zones have made many explorations and efforts around technology market construction, laying the foundation for China' s intellectual property market, scientific and technological achievement transformation, and technology transfer markets from scratch. However, the current development of knowledge markets far from meets the development needs of the new era. With the arrival of the knowledge economy, knowledge element transactions will inevitably become the most active and most potential category in new economic markets. Emerging forms such as crowdfunding, crowdsourcing, various dual-creation platforms, and angel investment platforms provide diversified implementation forms for such market transactions. This requires high-tech zones to innovate and develop knowledge markets with great intensity, actively carrying out related model innovation, business form innovation, and institutional mechanism innovation. Especially the knowledge capitalization (intellectual capital) market—intellectual capital markets allow third-party capital (knowledge supply and demand are the first and second parties) to enter the processes of knowledge creation, knowledge circulation, and knowledge value-added. Through knowledge condensing capital—capital intervention in the R&D stage, through capital materializing knowledge—angel investment-supported innovation and entrepreneurship, through profiting

from intellectual capital markets—capital rights exchange of condensed knowledge, enhancing the prosperity of knowledge-targeted capital markets. For example, crowdfunding condenses capital through knowledge, crowdsourcing absorbs knowledge through capital, and dual-creation platforms promote the transaction and exchange of knowledge equity capital, all of which are new scenarios and forms that enhance knowledge capitalization transaction markets.

The greatest innovation and exploration for high-tech zones in promoting intellectual capital market development currently lies in how to provide legal channels or compliant rules for the entry and exit of third-party capital. Knowledge capitalization market construction is an unexplored territory globally. National high-tech zones should seize the opportunity, take the lead in conducting policy pilot trials, and strive to become global leaders in this regard.

**3.3.5 Smart Park Construction and New Urbanization** After 30 years of construction and development, the form, scope, scale, connotation, and quantitative composition of national high-tech zones in the new era have undergone fundamental changes: The boundary of national high-tech zone construction at that time was to designate a policy area and plan an industrial land area, with the geographical jurisdiction scope generally being very small. Now, the geographical jurisdiction scope of national high-tech zones in various places has generally expanded, occupying a considerable portion of urban geographical space. The construction connotation of national high-tech zones is also continuously increasing, from being merely an industrial park in the past to now having become an urban part with close economic and social integration. The number of national high-tech zones has increased, now touching nearly half of China' s prefecture-level cities. In fact, today most national high-tech zones have become the most socially vibrant and new population-attractive new urban areas in their localities, making it impossible to view high-tech zones from the perspective of past industrial parks or industrial bases. The integration of industry and city in high-tech zones is both inevitable and necessary.

From the perspective of global urban development, exploring urban forms that carry intelligent social civilization is an inevitable direction for humanity. This requires high-tech zones in the new era to regard building an "innovation economy" and promoting innovative city construction as new national missions, leading China' s new urbanization. New city construction mainly involves three aspects: natural ecology, artificial environment, and public services. With the arrival of intelligent civilization, the construction and optimization of these three aspects cannot be separated from the application of new technologies and the innovation of operation and management models brought by new technologies: Protecting and utilizing natural ecology requires the use of IT technology, Internet technology, and intelligent means for detection, monitoring, replenishment, and optimization; Building artificial environments requires physical or digital infrastructure such as the Internet, big data, cloud computing, and artificial intelligence; Conducting public services requires information network connec-

tions and big data to provide precision, convenience, and efficiency. These aspects are all part of smart cities or smart parks in the broad sense. Only when these aspects are well built can the five concepts of "innovation, coordination, green, openness, and sharing" proposed at the Fifth Plenary Session of the 18th Central Committee of the Communist Party of China be implemented in practice, making cities livable and business-friendly, gathering talent, demonstrating urban influence and cohesion, and forming advantageous innovation economic ecology.

From the perspective of development trends, the future development form and connotation of high-tech zones will largely determine the direction and future of China' s new urbanization development. Therefore, the digital and intelligent urban area construction of high-tech zones is not only a quality improvement of the parks themselves but also a leadership in China' s urban development. Smart cities must carry intelligent society, and the management, governance, and operation methods of intelligent society are entirely new propositions globally. This requires national high-tech zones to make new bold explorations in institutional mechanisms, management, and operation models in conjunction with new-era development. Only through unremitting pioneering, enterprising, and innovation can we win the future.

As General Secretary Xi Jinping said: "Happiness is achieved through struggle."

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**30 Years' Construction of China National Hi-tech Industrial Development Zones and Their Development in New Era –To Commemorate 30th Anniversary of China National Hi-tech Industrial Development Zones**

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**Abstract**

By reviewing the 30-year history of China national hi-tech industrial development zones and their achievements, the paper reveals and analyzes the national impact and historical significance of constructing the national hi-tech industry development zones. Through an in-depth analysis of the transformation development of the hi-tech industry development zones and the challenges they face in the new era, this study proposes the target and general plan of developing "innovation economy" in the 3rd Entrepreneurship, as well as key measures of advancing national high-tech industrial development zones in the new era according to their current development.

**Keywords**
hi-tech industrial development zones, confidence in path, innovative economic ecology, new technology revolution, intelligent society

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*Note: Figure translations are in progress. See original paper for figures.*