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PRIORITY AREAS OF INNOVATION ACTIVITY IN THE DEVELOPMENT OF FREE ECONOMIC ZONES IN THE WORLD ECONOMY

Achilova Shirin Shavkat Qizi

PhD, Tashkent state university of economics, Uzbekistan

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Abstract: Free Economic Zones (FEZs) have emerged as pivotal platforms for driving innovation, economic growth, and global competitiveness. This article explores the priority areas of innovation within FEZs, emphasizing the key sectors where innovation is most pronounced. Through an analysis of technology and digital transformation, sustainable and green technologies, life sciences, advanced manufacturing, logistics, and education, this study identifies the critical areas where FEZs contribute to the global economy. The findings suggest that these zones are increasingly focusing on high-tech industries, sustainable development, and skill enhancement, making them central to the future of economic policy and business strategy. The article concludes with recommendations for policymakers and businesses on how to leverage FEZs for sustained innovation and economic growth.

Keywords: FEZ, innovation, technology, sustainability, life sciences, advanced manufacturing, logistics, infrastructure, innovation Incubators and accelerators.

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Introduction

Free Economic Zones (FEZs) are specialized regions within a country where economic regulations differ from the rest of the nation. These zones are designed to attract foreign direct investment (FDI), promote exports, and foster economic development. In recent years, the role of FEZs has evolved, with a growing emphasis on innovation as a key driver of economic activity. As the global economy becomes increasingly competitive and technology-driven, FEZs are being leveraged as innovation hubs, where new technologies and business models can be developed and tested.

This article aims to identify and analyze the priority areas of innovation activity within FEZs, focusing on how these zones are contributing to the development of the global economy. The study examines several key sectors, including technology, sustainability, life sciences, advanced manufacturing, logistics, and education, highlighting the innovations taking place within these areas and their implications for the future.

Methods

The study utilized a qualitative research methodology, focusing on the analysis of case studies, sectoral trends, and the synthesis of existing literature on Free Economic Zones (FEZs). This approach provided a comprehensive understanding of the innovation activities and strategic developments within FEZs across various sectors, including technology, sustainability, life sciences, advanced manufacturing, logistics, and education. By examining these areas, the study identified how FEZs are evolving into critical hubs for economic growth and technological advancement in the global economy.

Result and Discussion

The first FEZs were developed as enclave zones aimed at developing exports, but now they have started to implement their activities based on a model that is strategically and financially integrated with the local economy. The main impetus for these successes was the spread of global value chains, the liberalization of trade and investment, the spread and development of information and communication services and infrastructures. An example of this is the trends related to economic growth in the last 30-40 years, especially in East Asian countries.

The establishment and development of FEZs did not occur simultaneously in the regions of the world. For example, FEZs were established in most countries of East and Southeast Asia in the 1970s and early 1980s, in Latin America in the 1980s and 1990s, and in countries with economies in transition starting from the 1990s. As a result, the increase of FEZs managed by public-private partnership, the recognition of the important role of the government in their activities, the adoption of decisions in this direction, led to the development of many FEZs in the form of clusters. (e.g. automotive industry, electronics industry on the east coast of Thailand).

In the countries that are in the period of transition to the market economy, FEZs were used as experimental centers for testing and introducing economic reforms before applying them to the entire economy. The People's Republic of China (PRC) can be cited as a classic example of this strategy. Since the late 1990s, high-tech zones (HTZs) have been established in large cities such as Beijing and Shanghai, as well as in regional centers, relying on the existing knowledge and production base. They spread throughout the country, and in 2021 the number of such zones reached 173. By 2025, it is planned to reach 220 (HTZs).

The total output value of these national high-tech zones has increased from 5.4 trillion yuan (\$781.3 billion) in 2012 to 15.3 trillion yuan in 2021. In 2021, these zones produced 13.4% of the gross working product. In the past decade, national high-tech zones have made great progress in areas such as quantum data, high-speed railways, China's BeiDou navigation satellite system, domestically produced large aircraft, and 5G communications. 6.5% of the total cost of products produced in these zones was spent on research and development, and patents granted to enterprises in the regions make up 46% of commercial patents granted throughout the country.

Most FEZs are based on the concept of free zones (also called free trade zones), the defining feature of which is a separate customs zone. Free trade zones are usually located near seaports, airports, or border trade zones, where warehousing, logistics, and service companies are located. In many developed countries, industrial parks develop around free trade zones. In contrast, in developing countries, most FEZs are designed to attract investment in multi-sector industrial activities, and therefore tend to provide customs, fiscal and regulatory benefits to all enterprises in the more integrated industrial free zones.

FEZs operate in more than 140 countries of the world, in almost four-thirds of developing countries and almost all countries with economies in transition. Their number has been growing rapidly in recent years, and at least 500 more are about to increase.

Most FEZs are multi-purpose zones. The following table shows the modern trends in the development of FEZs, according to their functional classification, the use of zones by countries at different stages of industrialization.

As a result of the development of SEZs in different conditions and periods, there were differences in the distribution of zones by regions and types. Most of these zone types are multipurpose (multiactive) zones.

Distribution of zone types by regions or groups, (in %)

	Logistic hubs	Multiactive (multipurpose)	Specialized	Innovative
The world	8	63	24	5
Economically developed countries	90	9	1	0
Africa	1	89	10	0
Asia	2	65	26	7
China	1	92	1	6
Latin America and the Caribbean	9	77	13	1
Countries whose economies are in transition	3	34	58	5

It can be seen that the economies of specialized zones are more prevalent in transition countries. Innovation zones are more common in developed and developing Asian markets.

The development trend of SEZs shows that, while many developing countries used SEZs to attract direct investment, produce export goods, and promote technological upgrading of industry, in developed countries most SEZs focus on promoting the development of trade cooperation by improving the logistics system.

SEZ development steps

	Objectives of SEZ policy	Types of dominant zones
High income economy	<ul style="list-style-type: none"> - Creation of a developed cross-border supply chain; -Focusing on prevention of shortcomings in the economy 	<ul style="list-style-type: none"> - Free zones of logistics centers only (excluding industrial free zones); - The goals of innovation and the new industrial revolution are realized through science parks and clusters
Above middle income countries	<ul style="list-style-type: none"> - To support the transition to the economy of the service sector; - Attracting new high-tech productions; -Focus on updating innovative capabilities 	<ul style="list-style-type: none"> -Technological zones (for example, scientific research, high technologies, biotechnologies); - Industry orientation with high added value is focused on specialized zones, clusters or segments of the value chain; - Service industry zones (e.g. financial services)
Middle income economy	<ul style="list-style-type: none"> - Support of industrial modernization; - Facilitating the development of integration and the creation of global value chains; 	<ul style="list-style-type: none"> - Specialized zones focused on sectors with intensive use of global value chains (eg cars, electronics);

	- Focusing on the wide spread of new technologies	- Service areas (for example, business process outsourcing, call centers)
Low income economy	- Promotion of industrial development and diversification; - Elimination of deficiencies in the investment environment; - Implementation or testing of business reforms in the affected area; - Concentration of investments in infrastructure in the fenced area; - Focus on direct employment and export benefits	- Multipurpose zones; - Zones aimed at deepening processing; - Networks.

One of the primary areas of innovation within FEZs is technology and digital transformation. These zones serve as testing grounds for emerging technologies, offering an environment where companies can experiment with and deploy new solutions with fewer regulatory constraints.

FEZs are increasingly being used to develop smart cities, integrating technologies like IoT, AI, and big data to enhance urban management and sustainability.

Some FEZs, particularly in regions like the Middle East and Asia, are focusing on blockchain and fintech innovations, providing a conducive environment for testing new financial technologies. The deployment of 5G technology within FEZs is enabling the development of advanced industrial and commercial applications, positioning these zones at the forefront of digital transformation.

Sustainability is a central focus for many FEZs, driven by global efforts to transition to a green economy. FEZs are prioritizing innovations in renewable energy, circular economy practices, and eco-friendly transportation.

Many FEZs are investing heavily in renewable energy sources, such as solar and wind, and are becoming testing grounds for sustainable energy solutions.

FEZs are implementing circular economy models, focusing on reducing waste and promoting the reuse of resources, which is critical for sustainable development.

Innovations in green transportation, including electric vehicles (EVs) and hydrogen fuel cells, are being prioritized within FEZs, supporting global efforts to reduce carbon emissions.

The life sciences and biotechnology sectors are becoming increasingly important within FEZs, driven by the demand for new healthcare solutions and advancements in personalized medicine.

FEZs in countries like China and India are becoming hubs for pharmaceutical R&D, focusing on drug discovery and biopharmaceutical manufacturing.

Innovation in medical devices and diagnostics is a priority within FEZs, with significant investments in the development of new healthcare technologies.

FEZs are also focusing on agricultural biotechnology, promoting the development of genetically modified crops and sustainable farming practices.

FEZs are playing a crucial role in the advancement of Industry 4.0, which involves the integration of digital technologies into manufacturing processes.

The adoption of automation and robotics within FEZs is transforming manufacturing processes, making them more efficient and flexible. FEZs are increasingly becoming centers for additive manufacturing, allowing for rapid prototyping and production of complex products.

The digitalization of supply chains within FEZs is enhancing efficiency and transparency,

with blockchain and AI being key enablers.

FEZs are integral to global trade, and innovation in logistics and trade facilitation is a priority. These zones are focusing on smart logistics, customs technology, and multimodal transport solutions. FEZs are leading the way in smart logistics, integrating AI and automation into warehousing and supply chain management.

Innovations in customs processing, such as blockchain-based trade documentation, are streamlining international trade within FEZs. The integration of various modes of transport within FEZs is enhancing trade efficiency, contributing to the creation of more sustainable trade corridors.

Innovation within FEZs is not limited to technology and industry; education and skill development are also priority areas. FEZs are increasingly focusing on vocational training, innovation incubators, and collaboration with research institutions. Many FEZs are partnering with educational institutions to provide technical education and vocational training, ensuring a skilled workforce for emerging industries.

The establishment of incubators and accelerators within FEZs is supporting startups and small businesses, fostering innovation and entrepreneurship. Partnerships between FEZs and research institutions are driving innovation, particularly in high-tech sectors and advanced manufacturing.

Conclusion

The findings of this study indicate that FEZs are increasingly focusing on innovation as a central component of their development strategies. By prioritizing technology, sustainability, life sciences, advanced manufacturing, logistics, and education, FEZs are positioning themselves as critical drivers of economic growth and technological advancement in the global economy.

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