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## **DEVELOPMENT STATUS AND TREND ANALYSIS: NATIONAL SUSTAINABLE DEVELOPMENT PILOT ZONES IN CHINA**

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### **Abstract**

The 2030 Agenda for Sustainable Development adopted in 2015 attracted wide international attention. China's State Council issued the Development Plan for China's Innovation Demonstration Zone for Implementation of the 2030 Agenda for Sustainable Development in 2016, which offered a Chinese prescription for global sustainable development. Implementation of the Plan is based on National Sustainable Development Pilot Zones (NSDPZs). This gives rise to the question of what adjustments are needed to promote the development of NSDPZs under the Plan's guidance. This study aims to analyze the current situation of NSDPZs and explore the research direction in the future. Based on the development situations of NSDPZs over the past 30 years, this study investigated their spatiotemporal distribution characteristics, related research progress, and existing problems. Moreover, proposals are made for the key tasks of NSDPZs according to the Plan's requirements in terms of the following: exploring the mechanism for integrating science and technology innovation with social undertakings, solving the bottleneck problem in regional sustainable development, exploring avenues for high-quality development, and promoting the coordinated development of NSDPZs in eastern, central, and western regions. This study can serve as a reference for relevant decision making and provide rich cases demonstrating China's approach to sustainable development.

**Keywords:** China, pilot zones, spatiotemporal distribution, sustainable development, the 2030 Agenda

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### **1. Introduction**

Sustainable development (SD) has gained broad global consensus, becoming the mainstream model for development. The United Nations (UN) Sustainable Development Summit adopted the 2030 Agenda for SD in 2015, which set 17 global SD goals (SDGs) for the next 15 years, including poverty reduction, health, education, and environmental protection, among others. This was considered another landmark developmental action following Agenda 21 and the Millennium Development Goals, indicating that global SD had formed a new institutional framework (UN, 2015). Since then, the 2030 Agenda has received broad global support, and many international, national, and nongovernmental

organizations have proposed their own related action plans. At the Hangzhou Summit in 2016, for example, Group 20 adopted a plan of action for implementing the 2030 Agenda (Sun, 2016, 2017).

As the world's largest developing country, China plays an important role in global SD. Accordingly, China has attached great importance to implementing the 2030 Agenda. The State Council issued the Development Plan for China's Innovation Demonstration Zone for Implementation of the 2030 Agenda for Sustainable Development (hereafter, the Plan) in December 2016, providing its own prescription for global SD (The State Council, 2016). The Plan proposed selecting certain National Sustainable Development Pilot Zones (NSDPZs) with outstanding achievements and typical bottleneck

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problems of SD to create a number of replicable innovation patterns for SD. These zones, called Innovation Demonstration Zones for Sustainable Development (IDZSDs), were intended to promote SD domestically while also demonstrating China's experience for the benefit of other developing countries. Therefore, the NSDPZs should set an example for China's implementation of the 2030 Agenda and provide rich cases showing China's SD experience to the world.

Based on the development situations of NSDPZs over the past 30 years, this study analysed their spatiotemporal distribution characteristics, related research progress, and existing problems. On that basis, key tasks for NSDPZs are proposed according to the Plan's requirements to provide a reference for relevant decision making.

## 2. Overview of NSDPZs

### 2.1. Historical background

In 1972, the UN adopted the Declaration on the Human Environment, which was the first declaration to take global action to protect environment. In 1987, the World Committee of Environment and Development (WCED) issued the report *Our Common Future*, in which the concept of sustainable development was proposed for the first time. Meanwhile, China established relevant national policies and guidelines, including a national long-term policy for economic construction and work guidelines for science and technology.

Driven by policies of reform and opening-up and technological progress, China's economy began to recover, and many regions, especially the eastern coastal areas, achieved rapid economic development. However, social development lag, environmental deterioration and other problems began to appear. The NSDPZ program was started to solve these problems.

### 2.2. Tasks of NSDPZs

The NSDPZ program, one of first pilot projects for local SD in China, was promoted by governments at all levels, from central to local government. It aimed to improve the overall sustainability of local development based on advancements in science and technology as well as innovations of coordinated development mechanisms of economic, social, and environmental resources in various regions. By this way, it sought to provide examples for similar regions in the implementation of SD strategies.

### 2.3. Developmental phase

Corresponding to different periods of social and economic development in China, NSDPZ development has gone through four phases, as described below (ACCA21, MOST, 2006).

#### 2.3.1. Pilot phase (1986-1993)

Given the special situation in Southern Jiangsu Province, Changzhou and Huazhuang were selected by the former National Science and Technology Commission (NSTC; now known as the Ministry of Science and Technology (MOST)) and the National System Reform Commission (NSRC) to begin the integrated pilot project for social development in 1986. Its purpose was to explore coordinated paths of social and economic development with Chinese characteristics.

#### 2.3.2. Steady progress phase (1994-2002)

China's Agenda 21, promulgated in March 1994, established a national strategy for SD. Against this background, in December 1997, the Integrated Pilot Zones for Social Development were officially renamed as National Sustainable Development Pilot Zones (NSDPZs). Furthermore, the Management Method of National Sustainable Pilot Zones and the Work Guidance of National Sustainable Pilot Zones were issued in June 2001. As a result, aims of the NSDPZs were further clarified.

#### 2.3.3. Overall development phase (2003-2015)

At the 16th National Congress in November 2002, China stated its goal of building a prosperous society. Proposals for scientific development followed in 2004. Then, MOST promulgated the Management Method of National Sustainable Development Advanced Demonstration Zones (NSDADZs) in 2007. Here, 13 pilot zones, including Rizhao in Shandong Province, were specified, along with their corresponding tasks.

#### 2.3.4. Innovative development phase (2016-present)

In October 2015, the Fifth Plenary session of the 18th Central Committee of the Communist Party of China (CPC) established the Five Development Concepts, stressing the essential role of innovation in supporting SD. Then, the State Council issued the Plan, which proposed the construction of IDZSDs, and designated three IDZSDs-Shenzhen, Guilin, and Taiyuan-to promote the improved implementation of SD strategies.

### 2.4. Types of NSDPZs

NSDPZs are divided into five types according to administrative unit: big-city district, medium- and small-sized cities, counties, towns, and others (ACCA21, MOST, 2006). Big-city district refers to the downtown or urban/rural fringe area of a large city, such as Xicheng District in Beijing and Muping District in Yantai, Shandong Province. Representatives of medium- and small-sized cities include Changzhou in Jiangsu Province and Zhaodong in Heilongjiang Province. Counties, meanwhile, include Zhengding in Hebei Province and Zezhou in Shanxi Province, and towns include Ronggui in Guangdong Province and Zhulin in Henan Province.

“Others” types include the Yellow River Delta, the Longhu Mountain scenic area in Jiangxi Province, and the Shennongjia Forest District in Hubei Province. These areas are not directly reflected in the administrative divisions and have particular characteristics. For instance, the Yellow River Delta belongs to the same river basin, adjacent to each other in administrative areas, and has the common SD problem. Since such problems need to be solved jointly, cross-administrative NSDPZ regions were initiated in the Yellow River Delta.

### 3. Distribution characteristics of NSDPZs

#### 3.1. Characteristics of development phases

All NSDPZs can be included in specific phases according to when they were designated. They can be classified as east, centre, or west based on location (Fig. 1, Table 1). The largest number of NSDPZs (151) occupy the overall development phase, the total of which increased by nearly five times and fourteen times compared to the steady progress phase and pilot

phase, respectively, in the span of 14 years. The lowest number (11) was concentrated in the pilot phase, which lasted seven years. The innovation development phase is not compared here since its number will increase in future. Table 1 shows the quantity and proportion of NSDPZs in different regions. In the pilot phase, the number and proportion were the lowest in western and central China, while the number and proportion were the highest in the east. In the steady progress phase, both the number and proportion increased in western and central China while the number increased by only two in eastern China. In the overall development phase, there were 33, 51, and 67 in western, central, and eastern China, respectively. Although the total number of NSDPZs in western China increased by nearly five times, the proportion decreased from 24.14% to 21.85% compared to the steady progress phase. Meanwhile, the total number in eastern China increased by nearly six times, and the proportion increased from 37.93% to 44.37%. In the innovative development phase, there were three IDZSDs, one each in eastern, central, and western China.

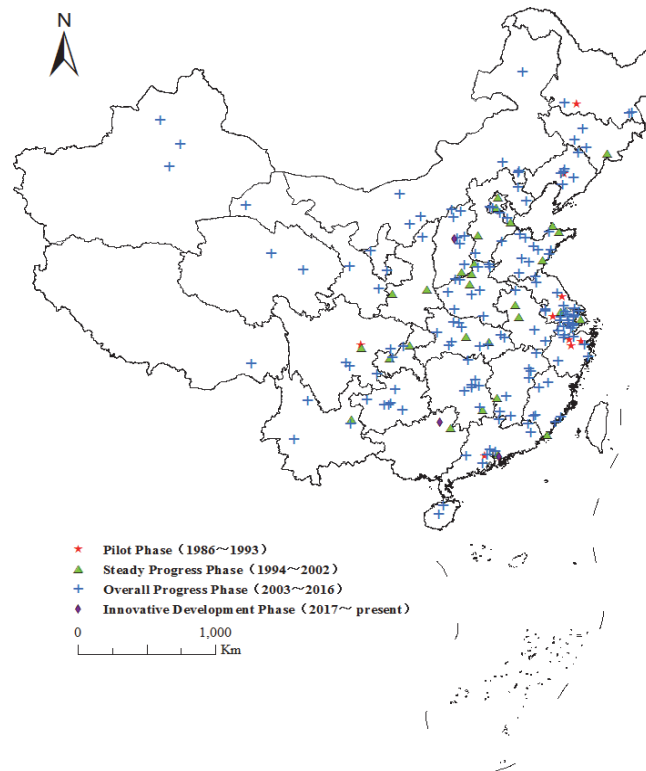


Fig. 1. Spatial distribution of NSDPZs in different development phases

Table 1. Distribution status of NSDPZs in different development phases

Phases	Total	Western China		Central China		Eastern China	
		Number	Proportion (%)	Number	Proportion (%)	Number	Proportion (%)
Pilot	11	1	9.09	1	9.09	9	81.82
Steady progress	29	7	24.14	11	37.93	11	37.93
Overall development	151	33	21.85	51	33.77	67	44.37
Innovative development	3	1	33.33	1	33.33	1	33.33
Sum and proportion	194	42	21.65	64	32.99	88	45.36

Note: data collated according to the website of China agenda 21 management center

In short, the construction of NSDPZs was the fastest and largest in the overall development phase, and the number of NSDPZs increased rapidly in western, central, and eastern China, respectively. However, most NSDPZs were located in eastern and central China while western China has always had the minimum proportion.

3.2. Characteristics of types

NSDPZs can be grouped according to type and classified by location, as shown in Fig. 2 and Table 2.

Among the 189 NSDPZs (excluding Huazhuang in Jiangsu Province and Luozhuang in Shandong Province, which were canceled due to adjustments to administrative divisions), there are 58 big-city districts, 70 medium- and small-sized cities, 50 counties, 8 towns, and 3 others, accounting for 37%, 31%, 26%, 4%, and 2% of the total NSDPZs,

respectively. The number of medium- and small-sized cities is the largest, and the number of towns is the smallest (excluding “others”). It is worth noting that the distribution of NSDPZs has increased successively in the order of west, center, and east. Regardless of the total number or proportion, western China has had the least for all of the types. The number of medium- and small-sized cities and the proportion of big-city district have been the largest in western China, where the number and proportion of towns are the lowest. Among 8 towns, there is none in western China, 2 in central China, and 6 in eastern China.

It is clear that the types of big-city districts and medium- and small-sized cities have dominated the process of NSDPZs construction. Similar to the development phase, all of the types of NSDPZs have mainly been distributed in eastern China, with the fewest in the western region.

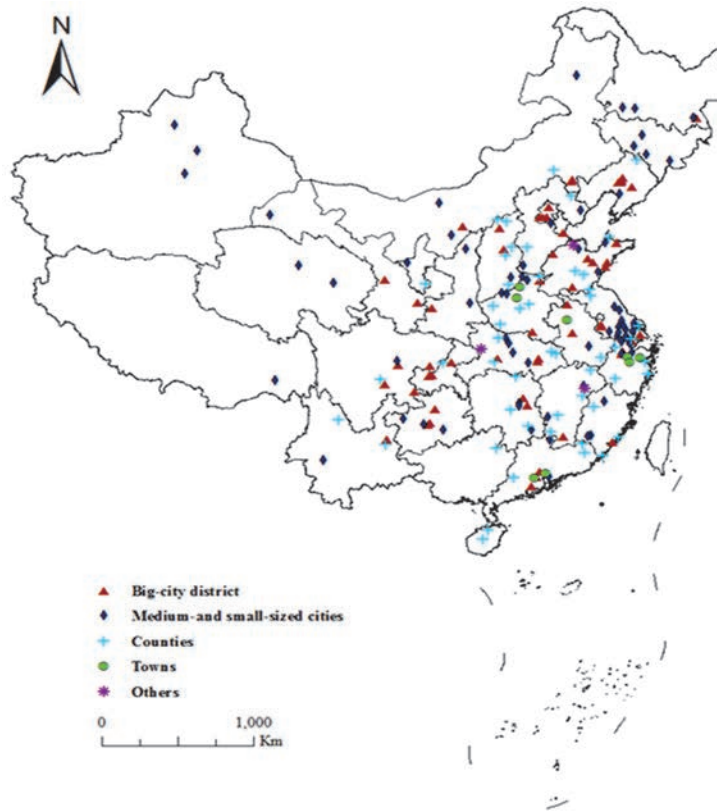


Fig. 2. Spatial distribution of different types of NSDPZs

Table 2. Distribution status of different types of NSDPZs

Type	Total	Western China		Central China		Eastern China	
		Number	Proportion (%)	Number	Proportion (%)	Number	Proportion (%)
Big city district	58	17	29.31	13	22.41	28	48.28
Medium-and small-sized cities	70	18	25.71	22	31.43	30	42.86
Counties	50	7	14.00	22	44.00	21	42.00
Towns	8	0	0	2	25.00	6	75.00
Others	3	0	0	2	66.67	1	33.33

Note: data collated according to the website of China agenda 21 management center

### 3.3. Summary

By the end of 2018, 194 NSDPZs covered more than 90% of China's provinces (Autonomous regions and Municipalities directly under the Central Government), except for Hong Kong, Macao, and Taiwan. The number of NSDPZs in eastern, central, and western China showed a distribution pattern of 5:3:2. The proportion of medium- and small-sized cities is the largest, and the town is the smallest. In summary, the major problem is the imbalance of regional distribution, followed by the type of town, which developed slowly in the construction of NSDPZs.

## 4. Research progress on NSDPZs

### 4.1. Analysis of research progress

In China, research on NSDPZs began in the 1980s. As an important field of SD theory and practice, NSDPZs have attracted considerable attention. After more than 30 years of exploration, many research results have been achieved. In order to explore the research tendencies corresponding to the increase in the number of NSDPZs, according to the development phases of NSDPZ, relevant literatures are combed, and the research characteristics of each development phase were obtained.

#### (1) Theoretical exploration

Eleven NSDPZs were designated in the pilot phase. There was only one noteworthy study from this time. Ke (1993), a Chinese researcher, clarified theories related to NSDPZs and proposed measures to construct a healthy development environment. The remaining literatures mostly pertained to conference notices, planning examination and approval, and reports on NSDPZs. Clearly, research in this phase was at the theoretical level and lacked in-depth analysis.

#### (2) Expanding the research

29 new NSDPZs were increased in the steady progress phase. Correspondingly, the number of literatures increased, and their content became more developed. In addition to constructing ideas and measures (Xu and Chi, 1994), practices and effects (Chi, 1999; Lin et al., 1998), and experience and prospects (Song, 2002), the research expanded to investigation reports (Zhou, 1994), evaluation theories and methods (Zhang and Liu, 1997), as well as capacity building and regional comparison (Cao, 2000; Lai, 2001). Empirical studies expanded as well, covering Huazhuang in Jiangsu Province, Qiurai in Zhejiang Province, and other NSDPZs established in the pilot phase, as well as Xuhui District in Shanghai, Xicheng District in Beijing, and others established in the steady progress phase. In short, the research during this phase had expanded from theoretical analysis to combination of theory and practice. Research methods had also been extended to quantitative approaches, attaching greater importance to empirical analysis.

#### (3) Comprehensive improvement

During the overall development phase, 151 NSDPZs were added. The related research increased sharply as well, showing breakthroughs in the depth and breadth of content and methods compared to the first two stages. These developments can be summarized in terms of two aspects.

On the one hand, the research fields continued to expand. With the deepening of theoretical research, new research fields emerged. For instance, Yang (2014) proposed a green and low-carbon development path for NSDPZs. Liu (2007) discussed the development path of circular economy while Cui (2003) studied the construction methods of public information networks in NSDPZs. Yao et al. (2014) examined the implementation of science and technology plans. Moreover, Ma and Yang (2014) explored the institutional innovation and development paths of NSDPZs.

On the other hand, researches on evaluation became hot topics, which can be divided into three aspects. First, the research covered almost all types of NSDPZs, including NSDADZs (Liu et al., 2007), state level NSDPZs (Xu, 2008), and provincial level NSDPZs (Xiang, 2013). These studies included empirical research on county type (Xu, 2008), a comparative study of the medium-city type (Li, 2011), and an evaluation of different grades of NSDPZs in the same region (Zhang, 2013). Second, the indicator system was mostly based on data released by MOST, including sets of indicator system such as population, ecology, resources, environmental economy, and society, as well as science and technology education. Third, evaluation methods tended to diversity. For instance, analytic hierarchy process, fuzzy comprehensive evaluation method, principal component analysis, and emergy analysis were used to evaluate development levels (Li and Cao, 2012; Tang et al., 2013; Zhang, 2013). The formula method was used to evaluate the coordination of pilot zones (Xu, 2008). Li and Cao (2012), meanwhile, integrated energy flow and material flow methods to evaluate the development levels and coordination. Finally, the linear weighted comprehensive evaluation method had been used to evaluate the implementation effect of NSDPZs (Zhang, 2010).

#### (4) Innovation drive

Since the beginning of the innovative development phase, three IDZSDs have been established. Following the issuance of the plan, Sun (2018) analysed its formulation, significance, and content, highlighting the importance of science and technology innovation in its implementation. Some new research fields have also emerged, such as the evaluation of NSDPZs' innovation ability (Wang et al., 2017; Zhu and Liu, 2017), the interaction between scientific and technological innovation and SD (Liu and Li, 2018). In addition, the sustainable development evaluation index system of NSDPZs was constructed with scenario analysis methods (Zhang et al., 2018). It is clear that the implementation of the

IDZSD has become a focus of China's commitment to promote SD.

#### 4.2. Discussion of existing problems

The above analysis shows that the existing studies have investigated various aspects of NSDPZs. However, due to the late start of related research, there are still many problems in the research, including lack of experience in construction and management, and lack of knowledge of possible difficulties and key technologies. First, research has not focused equally on the eastern, central, and western regions. This is mainly attributable to uncoordinated socioeconomic development in the eastern region and the large cities during the period of rapid growth. As a result, the number of NSDPZs in the eastern region is the largest, followed by central and western China, and the related research has shown a similar trend.

Second, even though there are many theoretical and empirical studies, they are lacks of breadth and depth. Furthermore, systematic and mature research frameworks have not yet been formed. In recent years, more and more attention has been paid to the research on evaluation. Meanwhile, the field of research has been gradually increasing, and the research methods have been tending to diversity. Yet, many studies have focused on hierarchical type or single regional type, and less attention has been paid to different regional types. At the same time, the evaluation research has focused on the development level and coordination, but ignored the evaluation of sustainability and efficiency.

Most of the evaluation indexes are similar, which don't reflect the differences among different types of NSDPZs, particularly, public participation factors and 2030 agenda indicators are not taken into account (Szopik-Depczyńska et al., 2018). Moreover, the existing research methods have their own advantages and shortcoming. There are lacks of integration research of various methods and support of geographic information technology. In addition, some studies have focused on exploring influence factors. Currently, the impacts of technology, institutions, and innovation have been discuss. However, the influence mechanism of policies and systems on the development of pilot zones has been unclear.

Third, most of the existing research has focused on the development status of NSDPZs or their related problems. Given that China is in the period of economic and social transition, there remains a lack of systematic understanding of the research on green, low-carbon, and ecological transformation in NSDPZs. Finally, compared with a large number of top-down theoretical and practical studies, there is a relative lack of bottom-up practical and theoretical research (Zhong et al., 2018).

#### 5. Possible trends in NSDPZs

So far, the NSDPZs have been a banner of the implementation of national SD strategy in China. With

the promulgation of the Plan and the implementation of its objectives, their key research directions have been gradually clear.

(1) The research further focuses on the combination of the development mechanisms of science and technology innovation and social undertakings. At present, there is a global consensus on the use of technological innovation to promote SD. How to promote sustainable development is the core issue of the plan. It is clear that social undertakings are pregnant with the possibility of new economic growth, which can promote coordinated development of economy and society by stimulating the vitality of innovation (Xu, 2016). Therefore, a key direction of the NSDPZs is the interaction between scientific and technological innovation and SD and its subsystems of economy, society and environment. The combination of scientific and technological innovation and social undertakings may provide support for the overall implementation of innovation-driven development strategy in China.

(2) The focus of related research is on solving the bottleneck problem of regional sustainable development. The Plan emphasizes the selection of typical NSDPZs with outstanding development results and bottleneck problems. Then, replicable models can be created with innovation-driven development. As pilot areas, the NSDPZs undertakes the task of solving regional development problems. Therefore, according to the requirements of the plan, it is necessary to evaluate the development effects of existing NSDPZs, analyse the influencing factors, and screen out bottleneck problems. In practice, it is essential to choose applicable science and technology to create new management forms and new modes in high-end industries. This will help to form mature and effective solutions to such issues as poverty alleviation, waste utilization, clean energy, and others listed in the Plan.

(3) Finally, exploring a way of high-quality development is also one of the key research directions. Transition is the core issue of regional development in China. With the adjustment of economic, social and industrial structure in the progress of transition, new problems appear constantly, which presents new challenges for the implementation of regional SD strategies (Long, 2012). Thus, the adjustment and innovation of systems, operating modes, and development strategies are also important directions of NSDPZs based on the changes of internal and external environmental conditions. This will help to form a way of high-quality development through strengthening weak links, optimizing the allocation of resources, and fostering new drivers of growth.

#### 6. Conclusions and discussion

As one of the first countries to propose and implement an SD strategy, China has been experiencing a rapid process of industrialization and urbanization, which is also in a critical period of economic and social transformation. The purpose of constructing NSDPZs is to promote regional SD by

means of accumulating experience and exploring new models of economic development. This is helpful to solve the common problems in the process of local and regional development. After years of research, scholars have reached a consensus on the significant effects. In particular, some SD models have been formed, such as Anji model in Zhejiang Province for beautiful countryside construction, Zixing model in Hunan Province for water source protection, and Gongcheng model in Guangxi Province for ecological recycling agriculture. These models have drawn wide international attention and contributed rich materials and cases that demonstrate solutions in China. NSDPZs have become the banner of implementing the national SD strategy, the key direction of which has been clarified by the Plan and its implementation.

As for the potential avenues of future research, we give the following suggestions. First of all, it is very necessary to study the characteristics of development process, influencing factors, common regular and general mechanisms of the above successful pilot zones, which can provide referable and replicable models for other similar areas. Meanwhile, the radiation functions can be used to drive the SD in larger regions, which can promote elements interaction and industrial synergy from pilot zones to their surrounding areas.

In addition, under the background of transformation, it is also very important to strengthen investigation analysis and prospective study on the new situation and problems in different types of NSDPZs, such as the development process of new-type urbanization, integration and development of urban and villages, problems of aging populations, and so on. This study will provide the references to explore optimal development strategies, serve government decision-making, and promote higher quality development of NSDPZs.

With the implementation of the Plan and the ongoing construction of IDZSDs, other issues arise. First, more attention should be paid to the ability to improve SD in the central and western regions to promote coordinated and balanced regional development. Second, considering the three established IDZSDs (the megacity of Shenzhen, the resource-based city of Taiyuan in Shanxi Province, and the scenic city of Guilin in Guangxi Province), county and town types should be strengthened to promote more diversified development. Finally, platforms of communication and cooperation should be established, with the theme of science and technology innovation driving SD. In this way, China can present a SD plan to the world and contribute to the global implementation of the 2030 Agenda.

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