DOI 10.15302/J-SSCAE-2019.05.003

Constructing a "No-Waste Society"

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Abstract: Solid waste reduction and resource utilization is a sign of national progress and modernization. The massive amount of solid waste produced in industrial production and daily life in China has not been well treated, and the annual output of solid waste is growing year after year. It is proposed in this paper that a "no-waste society" does not refer to a society without solid waste production, but rather a society in which most solid waste is properly reused as resources. "No-waste society" is guided by the new development concepts of innovation, coordination, green development, openness, and sharing, and promotes living based on green development and recycling, so as to achieve source reduction, resource utilization, and the harmless treatment of solid waste to the largest extent. This paper further clarified the boundary and scope for the "no-waste society," described its characteristics, and proposed the general idea and direction of developing from "no-waste city" to "no-waste society." Furthermore, policy measures were proposed, including strengthening collaboration andsupervision; advocating the concepts of a diligent and thrifty life; and enhancing international exchange to actively participate in the construction of a global system for environment governance.

Keywords: no-waste society; no-waste city; solid waste; resource utilization; production mode; living mode

1 Introduction

As a highly populous nation, China has generated an enormous amount of solid waste in the process of industrial production and daily life. According to statistics, China's accumulated quantity of different types of solid waste amounts to 6×10^{10}–7×10^{10} t, and the annual output is approaching 1×10^{10} t [1]; both display an increasing trend every year. Such a massive accumulated quantity and annual output of solid waste will lead to severe environmental pollution and a huge waste of resources if not treated and utilized properly, and exert a destructive impact on society [2]. The reduction and resource utilization of solid waste are signs of national progress and modernization levels, which is an indicator of the standard of the regional construction of ecological civilization. They also serve as concrete and powerful levers with which to advance the modernization of the social governance system and foster good citizenship. Thus, scholars proposed the concept of a "no-waste society." [3] The realization of this conception requires sustained long-term efforts. The State Council of the People's Republic of China issued the "no-waste city" pilot construction work plan, with the aim of furthering the reform of integrated solid waste management at the overall municipal level through the construction of "no-waste city"

Received date: July 25, 2019; **Revised date:** August 10, 2019

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Funding program: CAE Advisory Project "Research on Several Strategic Issues on Ecological Civilization Construction (Phase III)" (2017-ZD-09)

Chinese version: Strategic Study of CAE 2019, 21 (5): 144–150

Cited item: Liu Xiaolong et al. Constructing a "No-Waste Society" *Strategic Study of CAE*, https://doi.org/10.15302/J-SSCAE-2019.05.003

pilots, so as to form a replicable construction model that can be widely promoted, and promote the construction of a “no-waste society.” [4] This paper enriches the implications of a “no-waste society,” further clarifies its boundary and scope, and describes its characteristics. It also proposed the general idea and direction for the shift from “no-waste city” to “no-waste society.” Finally, recommendations on policy measures were put forward.

2 Implications and boundary of “No-Waste Society”

2.1 Concepts and implications of a “No-Waste Society”

Currently, there has yet to be a universal concept known as “no-waste society” among the international community; however, there have been similar propositions. Examples include “Towards a Circular Economy—a Zero Waste Programme for Europe” issued by the European Commission in 2014, the “circular society” proposed by Japan [5], Singapore’s vision of a “zero-waste country,” and Taiwan’s goal of constructing a “zero-waste society.” [6] Most developed countries and regions that have adopted “zero waste” as their national strategy aim to resolve problems such as the bottleneck in natural resources, occupation of scarce land resources by waste disposal, and environmental pollution, promoting the concept of a circular economy within the economic system and extending it to other aspects of social life, with “zero waste” as their vision and direction of development. Developed countries and regions like those in the European Union and Japan have already adopted the reduction and resource recovery of solid waste as the important paths with which to transform the economic development model, thus gaining positive outcomes from the process.

In China, the concept of a “no-waste society” was proposed by domestic scholars [3]. In this paper, it is believed that a “no-waste society” does not mean zero output of solid waste throughout society. Rather, it is a society in which solid waste is largely reused as resources. Intrinsically, it is guided by new development concepts of innovation, coordination, green development, openness, and sharing. Through promoting the formation of a green and circular development model and lifestyle, it advances a social development model that involves the source reduction, resource utilization, and harmless treatment of solid waste to the largest extent.

The concepts and implications of a “no-waste society” have transformed the past management model of waste reduction based primarily on production sources and resource recovery from already-produced solid waste, shifting towards expanding demand for consumer goods that reduce resource consumption and solid waste generation, and forcing industrial production and social development models through the supply side into shifting towards green development models of conservation, intensive use, and recycling of resources. Solid waste comprises the attributes of both pollutants and resources. Recently, with the continuous exploration in research on socio-economic development models, the focal point of the environmental management of solid waste has gradually shifted from end-of-line treatment to the integrated and coordinated management of solid waste and resources. The attributes of solid waste as resources has been gaining increasing prominence every day. Solid waste management should be elevated from simple environmental management to the comprehensive management of the socio-economic system, and from the passive recycling of solid waste resources to the active recycling and recovery of materials.

2.2. Boundary and scope of “No-Waste Society”

A “no-waste society” targets all of the solid waste produced during socio-economic activities [7]. They include “urban mines,” rural waste, and industrial solid waste; however, waste water and waste gases are excluded. The boundary of such a society includes both urban and rural areas. The construction of a “no-waste society” requires differential and phased implementation based on the characteristics of different regions and differences in levels of civilization between urban and rural areas. From the perspective of integrated urban–rural development, issues regarding the problem of collection, storage, use, and disposal of industrial, agricultural, and consumption waste of different types should be coordinated at a regional level. This can exercise the synergistic effect to the largest extent and comprehensively resolve the problem of municipal and rural solid waste.

2.3 Characteristics of “No-Waste Society”

The characteristics of a “no-waste society” can be divided into four aspects, namely, no waste, high efficiency,

DOI 10.15302/J-SSCAE-2019.05.003

smartness, and harmony.

The first aspect is no waste. “No-waste society” is a fundamental component of China’s second centennial goal and projected to be preliminarily constructed by the mid-21st century. A “no-waste society” does not mean zero output of solid waste throughout society. Rather, it represents a high level of resource utilization from solid waste and symbolizes advanced concepts of overall social development. It is the organic succession and integrated innovation of development concepts including green development, low carbon, and sustainability. The first and foremost goal of a “no-waste society” is source reduction, followed by reuse, recycling, and differential resource utilization, and eventually proper disposal, maximizing the economic value of products and resources, and minimizing waste output, improving the standards and efficiency of the fine classification and recycling of solid waste, promoting a high level of resource recycling, and building an integrated management system based on the coordination between solid waste and economic development, so as to gradually reduce the generation of solid waste.

The second aspect is high efficiency. A key characteristic of a “no-waste society” is the highly efficient recycling of resources in the overall society through the innovation of production modes. The innovation of production modes with the goal of attaining a “no-waste society” means to boost the efficiency of resource utilization and production, and diminish the generation of solid waste, through technological innovation and strengthened management in the field of production. The stages of production should be centered around the fulfillment of producer responsibility. Efforts should be made to design and produce easily recyclable products and provide more high-quality and eco-friendly products to satisfy the ever-increasing need for a beautiful ecological environment. Furthermore, the industrial layout should also be optimized. Based on the principles of prioritizing source reduction, cleaner production should be implemented to facilitate source reduction of industrial solid waste; the utilization of waste heat and residual pressure, as well as waste exchange between enterprises, should be promoted; a circular industrial chain, centralized pollution treatment, development of green infrastructure, and standardized management should also be enhanced.

The third aspect is smartness. Smartness is a prominent characteristic of a “no-waste society.” Through the smart management of solid waste, a more advanced, innovative, and intelligent form of society will be gradually presented. A “no-waste society” is a complex system. With the aid of new-generation information technologies such as big data, “Internet +”, and artificial intelligence (AI), it will bring about innovation and creation in industries associated with solid waste. Consequently, this will liberate productive forces at a fundamental level and foster the smart management of production and daily living, elevating the overall society to the level of a smart society. This is manifested in a number of aspects: it serves the society by achieving data sharing and information openness; it serves in daily management by allowing departments of solid waste management to streamline administration, delegate powers, and achieve smart management, through big data-assisted decision-making; it also serves the purpose of environmental emergency response, where emergency response resources are integrated for the purpose of emergency rescue through the real-time collection and dynamic analysis of data on the whole lifecycle of solid waste. In addition, the whole process of solid waste generation and treatment can be simulated through AI modeling to achieve goals such as optimizing product parameters, reducing energy consumption, increasing the utilization rate, and lowering waste output.

The fourth aspect is harmony. A “no-waste society” involves continuous improvement of the system of social governance and persistent innovation in ways of living. It paints a rosy picture of interdependence and harmonious coexistence between man and society as well as man and nature. To build a well-developed governance system for a “no-waste society,” the government, enterprises, and the public need to perform their respective roles and encourage the entire society to undertake the source reduction and differential resource utilization of solid waste. A community of shared interests among the government, enterprises, and the public should be formed, so as to shift the mentality from “avoiding one’s neighbors” to “helping one’s neighbors” in terms of disposal and management of solid waste, as well as gradually overcome the problems of “waste-besieged cities” and “waste-besieged villages.” Every citizen in a “no-waste society” should uphold the traditional Chinese virtues of diligence and thriftiness as well as firmly establish the values of respecting, conforming to, and protecting nature. They should also advocate moderate consumption and cultivate a green and low-carbon lifestyle and consumption pattern. To satisfy personal needs without harming the natural ecosystem, they should consciously boycott heavily

energy-consuming and high-polluting household goods, thus achieving a higher living standard with less waste. This serves to reduce waste production at the source and instill the notion of “no waste” deeply into citizens.

3 General idea and direction of development from a “No-Waste City” pilot to a “No-Waste Society”

The construction of a “no-waste society” is a systematic project that involves the livelihoods of people, the economy, and other aspects. It should adhere to the policies of “demand orientation, prioritization of pilot programs, site-specific approaches, and participation from all citizens.” To realize a “no-waste society,” it is necessary to make persistent efforts in the long run (the general idea is illustrated in Fig. 1). The process can first begin from a “no-waste city” pilot. A “no-waste society” is an advanced stage of the popularization and promotion of the construction of a “no-waste city”, which is a phased advancement of a strategic arrangement to ultimately fulfill the vision of a “no-waste society.” Places with favorable conditions can play an exemplary and facilitating role by taking the lead in exploring the establishment of “no-waste city” pilots. Through these pilots, alongside the sustained collation of pilot experiences, the formation of a replicable development model of a “no-waste city” that can be widely promoted may be accelerated. This model can be promoted to the entire country to lay the foundation for constructing a “no-waste society.” The construction of a “no-waste society” warrants the collective participation from the whole society and sustained hard efforts. It also requires the constant innovation and reform of the existing management system and mechanism for the purpose of gradual advancement. In the early stages of construction, “no-waste city” pilots are developed through institutional innovation, differential measures, and mode exploration as the levers, so as to further reform the comprehensive management of solid waste. Coordinated advancement and targeted breakthroughs are carried out in the three key areas of “urban mines,” rural waste, and industrial solid waste, to resolve the outstanding problems of solid waste. Innovation-driven approaches and refined management are adopted to promote the green transformation of production modes, so as to supply the society with more green consumer goods, facilitate the green transformation of living modes, and drastically reduce solid waste generation at the source, thereby improving the resource utilization efficiency in the overall society. A ternary system of social co-governance and sharing for all citizens, comprising the government, enterprises, and the society, is constructed to form a replicable construction model that can be widely promoted. This can promote the construction of China’s national development strategies and a development model of a “no-waste society” that aligns with the general national conditions, achieving a win-win situation in terms of resources, the environment, the economy, and society.

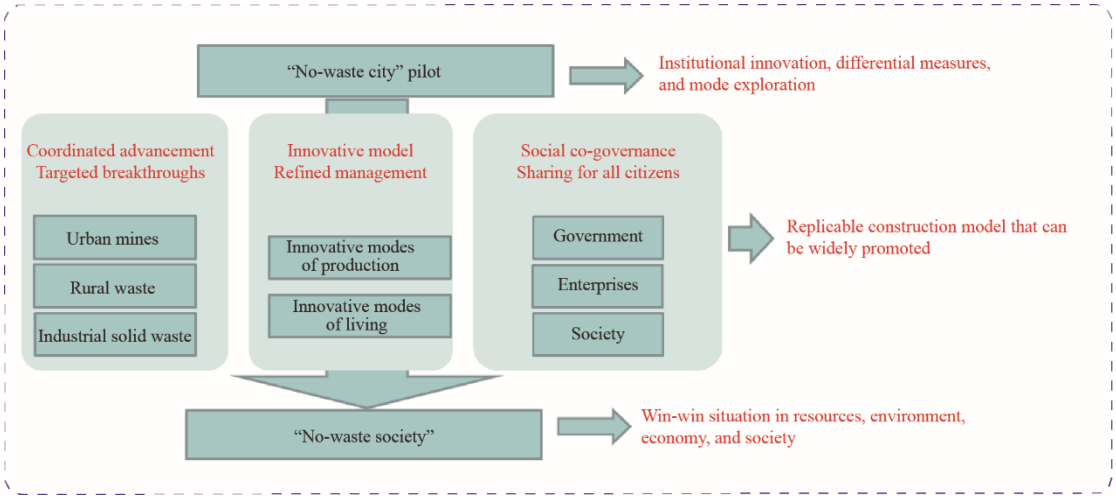

Fig. 1. General idea of development from a “No-Waste City” pilot to a “No-Waste Society.”

3.1 Constructing the differential resource utilization system of solid waste

Resource recovery is the key to reducing the inflow of solid waste into the final disposal stage, recycling

DOI 10.15302/J-SSCAE-2019.05.003

resources, and ultimately improving the resource utilization efficiency of the whole society. The practical experiences of developed countries and regions have shown that a higher level of differential resource recovery is associated with more efficient resource extraction. With reference to China's current sources of solid waste, resource attributes, and other characteristics and weaknesses, differential resource utilization should be carried out for solid waste of different types.

3.1.1 Developing "Urban Mines"

With priority in source reduction, and a focus on maximizing resource recycling and easing the burden on terminal treatment facilities, a complete system of categorized dumping, categorized collection, categorized transportation, and categorized treatment of waste should be constructed, with an emphasis on focal points and conducting differential measures. Refined management with differentiated focal points, product types, and fields is adopted, and the recycling and utilization of solid waste with lower recovery rate and resource value is strengthened.

First, the construction of an interconnected waste recycling and treatment system of categorized dumping, collection, transportation, and treatment should be accelerated. Second, a scientific, highly efficient, safe, and eco-friendly model for treating low-value urban waste should be explored to enhance the capacity for treating low-value waste. Last, a technical upgrade of the comprehensive utilization of resources should be implemented to elevate the added value of recycled products.

3.1.2 Coordinated recycling of rural waste

Under the framework of China's rural revitalization strategy, with the goal of protecting and improving the rural environment and enhancing the farmers' quality of life, a multi-tier comprehensive utilization model for both the centralization and decentralization of rural waste should be constructed according to their recyclability, reusability, and polluting characteristics. Also, with a focus on complementary collection and transportation systems, support policies should be refined and technical support should be strengthened, so as to systematically address the waste-to-energy and waste-to-resource treatment and utilization of rural waste. A diversified, standardized, and industrialized recycling pattern should be gradually formed to promote the green transformation and sustainable development of agricultural production and rural living.

First, efforts should be made to strengthen the construction of a social collection and storage system of crop straws and forestry residue. The utilization of such materials as fertilizers, feed, fuel, base materials, and raw materials should be coordinated and promoted. Second, a system of the coordinated utilization of waste from crop planting, livestock husbandry, agricultural by-product processing as fertilizers and energy should also be constructed more intensively. Last, a system of diverse approaches to the collection, transportation, and disposal of rural household waste should be built to facilitate the construction of clean, beautiful, and livable villages.

3.1.3 Differential resource recovery of industrial solid waste

With a focus on expanding the industrial scale of the differential resource utilization of industrial solid waste and enhancing the level of industrial development, as well as comprehensive consideration for environmental impact, long-term demand for resources, and technical and economic foundation, a long-term mechanism for the coordinated and optimized utilization and recycling of industrial solid waste should be built.

First, a technical and managerial system for the differential resource utilization of different types of industrial solid waste should be constructed, so as to maximize the resource utilization efficiency of industrial solid waste. Second, an ecological industrial chain based primarily on the tiered utilization of industrial solid waste should be established for industrial parks and cities, so as to achieve waste exchange and promote the coordinated utilization of various solid waste.

3.2 Innovative modes of production

Guided by eco-industrial and agro-ecological concepts, the general requirements of industrial ecologicalization and ecological industrialization should be fulfilled, and the green transformation of the whole industrial chain of industrial and agricultural production should be promoted, so as to push the society towards the reduction, resource recovery, and harmless treatment of solid waste throughout the entire process of social production.

3.2.1 Comprehensively promoting the construction of green manufacturing system

A “cradle-to-cradle” green manufacturing system centered around the fulfillment of producer responsibility and extended producer responsibility should be built to achieve the reduction, resource recovery, and harmless treatment of solid waste throughout the life cycle of manufacturing industries. First, green design should be promoted intensively. Second, sustained efforts should be made to improve the levels of clean production in key industries. Third, active steps should be taken to facilitate the construction of a green supply chain. Fourth, the development model of green industrial parks should be established. Last, the remanufacturing industry should be cultivated at a faster pace.

3.2.2. Promoting an agro-ecological mode of production

With reference to concepts of agro-ecological design, a reasonably-sized agro-ecological model of mixed crop–livestock farming should be built, with a focus on balanced crop–livestock farming, control and reduction of pesticides and chemical fertilizers, and rural supply of clean energy. Technological innovation and infrastructure construction should also be strengthened to stimulate the construction of new villages that are ecologically livable and work-friendly.

First, the use of pesticides and chemical fertilizers is controlled and reduced, so as to increase agricultural yield in an eco-friendly manner. Second, an agro-ecological model of mixed crop–livestock farming should be constructed to enhance the efficient utilization of livestock and poultry manure and crop straws. Last, the management and recycling system should be refined to promote the recycling of agricultural materials at the source.

3.3 Innovation in modes of living

With a focus on advocating and cultivating the concepts and values of green, low-carbon, natural, and simple living among all citizens, and through strengthening the supply of green products and services, a modern green lifestyle and consumption pattern that is efficiently resource-saving and environmentally friendly should be promoted.

3.3.1 Strengthening the supply of green products and services through supply-side reform

The green transformation of the tertiary industry should be sustained continuously. Efforts should be made to establish a green logistics system and advocate the adoption of new-energy distribution vehicles in e-commerce, express delivery, and food delivery. Reducing packaging and the use of biodegradable packaging in the processes of circulation should also be promoted. The stimulating effect of the circulation sector should be maximized, so as to enhance the construction of new circulating entities and operational models, such as green wholesale markets, green malls/shopping centers, green supermarkets, and green e-commerce platforms. The supply capacity of green product markets should be improved continuously, so as to accelerate the replacement of markets for non-environmentally friendly products, and develop the new trend of green consumption. New operations and new models such as the sharing economy and second-hand transactions should be developed in an orderly manner. Industrial management policies and measures such as the healthy protection of the industrial environment, management of information security, and information disclosure mechanism should be refined. An information-based supervision mechanism should be established, whereas the regulated development of commercial platforms such as the sharing economy, rental services, and second-hand transactions should also be promoted. The credit management of involved entities such as platform enterprises, resource providers, and consumers should be reinforced, so as to provide a basic guarantee for the orderly circulation and reasonable utilization of idle resources.

3.3.2 Cultivating green consciousness and green living behaviors among all citizens

The promotion and education of green living should be intensified to create an eco-environmental culture. Education in national consciousness towards green production and living should be bolstered. The development of a “no-waste society” culture, which involves green production and green living, should be incorporated into the national basic education system. The work of establishing green schools, green authorities, and green communities should be developed extensively with a primary focus on key aspects such as resource conservation,

DOI 10.15302/J-SSCAE-2019.05.003

recycling, and waste classification. The role of traditional and new media should be maximized to promote widespread publicity. Through role models and demonstration, knowledge, concepts, and methods pertaining to green production and green living should be popularized. Extensive promotion should also be conducted during promotional and educational themed events such as the National Energy Conservation Publicity Week, National Science Popularization Week, National Low-carbon Day, and World Environment Day, in order to encourage green lifestyles and create favorable public opinion. Teams of volunteer promoters should be assembled to enter into schools, institutions, and social communities to publicize and supervise green living behaviors such as the categorized dumping of household waste.

3.3.3. Fully leveraging on the stimulating and leading role of the public sector

The green procurement system should be developed. Resource-saving and environmentally friendly products of green design and those produced from the integrated utilization of resources should be prioritized in procurement by public institutions such as party and government authorities, state-owned enterprises, and public-sector organizations. A mechanism of compulsory government procurement should be established for waste-to-resource products that come with strong demonstrative and stimulating effects and higher costs incurred from the integrated utilization of resources. In the process of developing structures such as resource conservation authorities, green schools, and green hospitals, incentive mechanisms such as the replacement of single-use products, waste classification, and recycling should be reinforced.

3.3.4 Creating an ecologically livable rural environment

The remediation of the ecological environment in rural regions should be promoted. Infrastructure construction in terms of water and electricity supply, information, environmental health, distributed energy resources, and other aspects should be accelerated to boost the intensive use of resources and energy in rural regions. The environmental remediation of public spaces and garden environments should also be sped up. During the development of characteristic villages and towns, efforts should be undertaken to build robust facilities that align with the actual rural conditions, and diverse approaches for the classified and multi-tiered collection and disposal of household waste, wastewater, and the like, should be adopted. The efficiency of on-site differential resource recovery and waste-to-energy utilization should be elevated. Good rural customs and traditions should be cultivated. Group activities for the purpose of establishing a spiritual civilization, such as the establishment of “civilized villages and towns,” “star-grade civilized households,” and “civilized families,” should be implemented extensively, so as to advocate for the reduction and classification of household waste, as well as green minimalist consumption. This also improves the rural governance system integrating self-governance, rule of law, and moral governance. On the basis of the construction of rural grassroots integrated cultural service centers, more and better public cultural products and services in rural regions should be provided.

3.4 Constructing a governance system for a “No-Waste Society”

A well-established governance system for a “no-waste society” requires the consolidation and thorough implementation of the development concepts of innovation, coordination, green development, openness, and sharing. It should uphold the principles of market orientation, coordination and collaboration, openness and transparency, and scientific decision-making. With a focus on improving the ecological environment and raising the resource utilization efficiency of the overall society, and through institutional reform and technological innovation, market entities should be continuously invigorated, while expanding and regulating the green environmental industry. A new ternary pattern for co-governance by the government, enterprises, and society should be laid out, so as to achieve government administration and self-regulation in society.

3.4.1 Realizing strategic guidance and reinforcing the top-down design

First, the green transformation of the socio-economic development model should be led by the construction of a “no-waste society.” An evaluation mechanism for the development of a “no-waste society” should be formulated, in which socio-economic development is guided by the indicators of solid waste reduction, resource recovery, and harmless treatment. In addition, assessment indicators should be integrated into the performance appraisal system of the local governments. Second, the design of institutions and measures should be strengthened, so as

to implement policies for the construction of a “no-waste society” effectively. Institutional reform and innovation should be enhanced, and the powers and responsibilities of various departments, as well as the policy measures and legal standards, planning and infrastructure construction, and information management measures required for developing a “no-waste society” should be adopted. Supervision and law enforcement should be stiffened, so as to enhance the standards if reduction, resource recovery, and harmless management of solid waste continuously. Lastly, socio-economic development planning should be optimized to guide green and sustainable regional development. With emphasis on lowering solid waste output, lifting resource utilization efficiency, and effectively reducing the quantity of landfill waste disposal, the coordinated implementation of plans such as the national economic development plan and the urban spatial development plan should be conducted.

3.4.2 Strengthening economic regulation and cultivating industrial markets

The capacity of green finance in supporting the construction of a “no-waste society” should be strengthened, so as to invigorate market entities. Economic policies such as pricing, taxation, and finance should be refined, so as to reinforce the government’s market orientation, enrich the system of green financial products, utilize the green credit policy, green bonds, green stock indices, and related products, as well as harness financial tools such as green development funds, green insurance, and carbon finance, to formulate advisory and guiding policies such as green product catalogs and green investment guidelines. This can guide and motivate more investment from financial institutions and social capital into industries related to the reduction, classification, collection, and treatment of solid waste. It is also important to refine the regulatory mechanism of green finance, establish a statistical information database for green finance, and promote the construction of a system of environmental information disclosure, so as to shape a public governance system of social supervision and industry self-regulation. Fiscal incentives and economic policies—including value-added tax incentives, tax credit, pay-by-weight system for waste, tiered pricing mechanism, and subsidies for products made from the integrated utilization of resources—should be studied and improved, and government purchase services should be strengthened, with a focus on solid waste-related industries with high investment and low returns on investment, such as industries for the collection of low-value waste, the collection, transportation, and treatment of household waste, and the integrated utilization of industrial solid waste. The regulatory mechanism of consumption tax for substitutable products, luxury consumer goods, and the like, should also be refined, so as to foster a green lifestyle.

3.4.3 Promoting green transformation led by technological innovation

The technological innovation system for a “no-waste society” should be established, so as to secure the positions of innovation enterprises, as well as fully leverage on the decisive role played by the market in development directions and choice of technical route. Greater support should be given to technological innovation programs related to solid waste. Research on major scientific and technological problems should also be advanced. Meanwhile, a new investment mechanism in technological innovation combining key state investments in public welfare and the introduction of social capital investment should be established. Industry funds or social capital should be channeled effectively into the R&D and promotion of green processes and green products. International cooperation should be encouraged to track and introduce advanced eco-friendly technologies while drawing on advanced international experiences in management. Furthermore, the role of modern information technologies as the foundational support for resource recycling should be maximized. The Internet, Internet of Things, cloud computing, and big data technology should be harnessed to facilitate deep integration between “Internet +” and the differential recycling of renewable resources, public service platforms, and remanufacturing. A platform for sharing the state’s technological achievements with regard to “urban mines” should be set up, so as to improve marketization service standards for technological transformation.

3.4.4 Innovation in social governance and creating a “No-Waste” atmosphere

Accessibility and extensive public participation in environmental information should be enhanced. Smart “no-waste” ecological engineering should be implemented, and a new governance model of public participation should be constructed. The openness and transparency of institutional information should also be heightened, allowing the public to better understand, support, and supervise environmental efforts. The general public should be mobilized to actively and deeply engage in environmental work through various means and activities. An all-

DOI 10.15302/J-SSCAE-2019.05.003

weather, multi-level, and multi-source system for sensing and monitoring pollutant emission should be established, alongside a decision support system for managing the sources of environmental pollution and reducing pollutant emission. New-generation information technologies should be applied to better equip the society with environmental technologies and improve the environmental service capacity. The recycling of renewable resources and resource utilization of industrial waste through the "Internet +" model should be intensively promoted. A regulated and orderly recycling system should be established to enhance the coupling between forward and reverse logistics, while promoting the "dual-network integration" between the waste collection and transportation system and the recycling system of renewable resources. Demonstration projects should be constructed in fields such as the categorized recycling of rural and municipal solid waste, online transactions of major renewable resources, remanufacturing, and industrial symbiosis platforms.

4 Policy recommendations

The construction of "no-waste cities" and realization of a "no-waste society" are crucial strategic constituents for building an ecological civilization and a beautiful China, as proposed at the 19th National Congress of the Communist Party of China. Policy measures provide the essential underpinnings and guarantee for achieving this end. Scholars have called for the strengthening of China's top-down design and strategic position, and the elevation of the construction of a "no-waste society" to the level of a national strategy. It should form one of the strategies to "compensate for weaknesses," as part of the comprehensive efforts to build an overall moderately prosperous society. It should also be incorporated into the appraisal system of performance indicators for governments at all levels. A complete legal framework and robust standard system should be established with an emphasis on statistics. Efforts should also be made to clarify the objectives of each phase, promote social participation, enhance promotion and education, and buttress the social foundation. Investment and technical support should also be strengthened, among other measures [2]. Apart from these, special attention is also warranted in the following aspects.

4.1 Strengthening collaboration and supervision

With a focus on breaking down the interdepartmental barriers, managerial powers and responsibilities across different departments should be configured reasonably, and a joint supervisory mechanism of clear division of labor, mutual connections, and sufficient collaboration should be formed. A coordination mechanism should be established for a joint effort in promoting the construction of a "no-waste society," the coordinated study of key problems, and the coordination of key policies. Supervision over processes such as the collection, transportation, utilization, and disposal of various kinds of solid waste should be reinforced. The illegal transportation and overturning of containers holding various kinds of solid waste, as well as uncertified business activities in the collection, utilization, and disposal of hazardous waste, should be severely dealt with by the law. More stringent supervision and checks should be performed on the compulsory classification of household waste, disposal of construction waste, and resource utilization of solid waste. Sustained efforts should be put into combating illicit activities such as the illegal collection and dismantling of discarded lead–acid batteries, scrapped vehicles, and discarded electrical appliances and electronics. The investigation and prosecution of the production and sale of ultra-thin plastic bags and agricultural plastic sheets should be tightened. The comprehensive remediation of solid waste distribution centers should also be stiffened.

4.2 Advocating the concepts of diligent and thrifty living

The social governance model should be improved, so as to enhance humanistic management, cultivate better national citizenship, and strengthen promotion and education pertaining to the environmental management of solid waste. A collective consciousness towards green living should be cultivated through education in schools, communities, households, and enterprises, so as to heighten public awareness towards the urgency of resource utilization of solid waste, popularize concepts and knowledge on resource recycling, and advocate for traditional Chinese virtues such as diligence and thriftiness. In doing so, the concept of "no waste" can be instilled deeply into the hearts of all, and it is necessary to convert these concepts into concrete action.

4.3 Enhancing international exchange and interaction and actively engaging in the construction of a global environmental governance system

As the world’s largest developing country, China should make efforts to fully learn and draw upon the advanced experiences of developed countries and regions in the construction of a “no-waste society.” China should reinforce its coordination and interaction with other countries within the international community and with other countries. In addition, China’s construction of a “no-waste society” should adopt the strategic high ground of building a community of shared future for mankind. At the same time of implementing the resource utilization of solid waste in all aspects, China should continue to exercise its role as a responsible global power and uphold the global governance outlooks of negotiation, joint construction, and sharing. It should also actively participate in the reform and construction of the global governance system, becoming part of the joint effort in protecting the global environment and building a clean and beautiful world.

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