A Review of the National Green Innovation System in Israel

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Abstract. With the aggravation of resource and environment problems, countries around the world are paying more and more attention to design green innovation policy system for guiding the development of low-carbon economy. Especially after proposing the strategic conception of building an "innovative country" and a "resource-saving and environment-friendly society", China has witnessed a boom in green innovation research. However, China's green innovation system started late, while developed countries such as Israel have extensive experience in the research and development of green innovation system. This paper makes an in-depth analysis of Israel's green innovation system from the five aspects, i.e. energy conservation and environmental protection, public finance, education and talent introduction, green finance and technology. The experience of Israel can provide significant reference value for China to formulate and improve the green innovation system.

1. Introduction

Green innovation is also called ecological innovation, environmental innovation and sustainable innovation. Internationally, the rise of green innovation research can be traced back to 1990s. Kusz believes that environmental factors should be included in the whole process of product innovation and propose a green technology innovation process. Early scholars focused on the definition of green innovation from a narrow technical perspective. With the deepening of research, the connotation of green innovation has been greatly expanded. At present, most scholars agree that green innovation is a comprehensive concept. From 1992, the UN Rio Conference on Environment and Development adopted the "Rio Declaration" "Agenda 21" to the "Towards Green Growth" in 2011 and the "Rio+20" in 2012, the concept of green innovation is becoming more and more clear. It is the inheritance and development of popular concepts such as green economy, sustainable development, low-carbon economy, and technological innovation, and it is the comprehensive concept of the above words and highly generalizes the extension and sublimation. With the global shortage of resources, ecological and environmental issues and the increasing emphasis on sustainable development, green innovation has become a hot spot in innovation management research and Israel has achieved remarkable results in green innovation. This paper, by referring to the successful experience of the construction of Israel's green innovation system, hopes to provide some enlightenment to the development of China's green innovation system.
2. Energy conservation and environmental protection system

Israeli environmental laws are divided into subject laws and special laws. Special laws are laws dealing with special environmental issues involving air, water, noise pollution, the treatment of solid waste and hazardous substances and the protection of nature. Subject laws include the "Plan and Construction Law" and the "Business Registration Law", which not only provide a legal framework for environmental protection, but also serve as an important legal basis for controlling resource consumption and promoting sustainable development. The planning and building approval process should include environmental impact assessment, as required by the "Planning and construction law". The "Business Registration Law" provides effective macro supervision of enterprises through the conditions of business registration to prevent new pollution.

In terms of water resources management, Israel enacted the Water Law, a Framework Law for the protection of water resources in 1959, stipulates that all types of water resources belong to state’s property, are controlled by the state and serve the development of the people and the country. Subsequently, in 1962, Israel enacted the "Local Sewage Law", which clarifies the powers and obligations of local governments in the design, construction and maintenance of sewage systems. The Public Health Regulations of 1981 regulates the content of wastewater treatment and a specific list of crops suitable for irrigation wastewater. In 2008, the Israel Water Authority released a national long-term master plan of water resources, which sets the goal of achieving the annual desalinated water to reach 750 million cubic meters by 2020 [1]. The "Quality Standards and Rules for Wastewater Treatment", introduced in 2010, supersedes the 1992 "Public Health Regulations" on wastewater treatment, and sets higher requirements for future wastewater treatment plants: the concentration of chloride ions in wastewater should not exceed 80 mg/L, and the concentration of boron should not exceed 0.3 mg/l. On the water resources management agency, Israel's water policy network was formed in the 1950s with the ministry of agriculture, water conservancy commission, and parliamentary water committee and water council [2]. In 2007, Israel abolished its water conservancy commission, which had been in existence for nearly 50 years, and established the Water Authority, while absorbing the intelligence of the Ministry of Infrastructure and the Ministry of the Interior on water management and centralizing the power of water policy making, which greatly improving the work of water resources protection effectiveness.

On air pollution control, as early as 1962, the Israeli government banned the emission of black smoke to public areas. In 1993, it was banned from burning plastics in farmland. "The Environmental Declaration Registration Obligation Law", promulgated in 2012, lists 114 pollutants and 74 pollution activities that need to be registered. In 2013, the Israeli government announced the air pollution reduction plan for 2020, which emphasizes air pollution caused by transportation, industry and life, encourages citizens to use carpooling and public transport, and strengthens penalties for air pollution. The Israeli government has been working to reduce its reliance on fossil fuels to alleviate air pollution: Article 3954 of the "2008 Government Solutions" decides to establish a renewable technology R&D center in the Negev region to increase theoretical and practical research on renewable energy. Section 4450 of the "2009 Government Solutions" sets a target of 10% of electricity from renewable sources by 2020 and 17% from renewable sources by 2030. In 2008, the "Government Solution" No. 3261 sets a goal of reducing electricity consumption by 20% by 2020 and this indicator is increased to 20% in 542 of the "2015 Government Solution" [3].

3. Public Financial system

The 2007 "Clean Law Amendment" requires garbage dump operators to pay taxes on each ton of garbage to dedicate maintenance and cleaning fund in order to promoting the development of recycling and recycling technologies [4]. The tax rate is levied according to the type of waste and is gradually increased over five years. In 2009, the Israeli government implemented a "Green Tax" reform for vehicle taxation. The reform plan is to increase the purchase tax on private cars from 72% to 90%. At the same time, based on the different emission levels of consumers, the vehicle purchase tax was measured by weighing calculation of all relevant and measurable emissions. The fifteen
pollution levels were adjusted with the goal of forming differences between different emission levels and kept tax revenues unchanged [5]. In 2010, the Israeli vehicle purchase tax was reduced to 83% and the ABS mandatory system was cancelled. Different from other European and American countries, Israel's green emission levels are calculated based on five emission sources (NOₓ, CO, PM, HC, and CO₂), while European and American countries are limited to one source (CO₂), showing the standardization and comprehensiveness of Israel's vehicle green emission system.

In Israel, companies engaged in energy research and development activities can enjoy certain tax benefits. Israel enacted the "Encourage Investment Law" in 1959 to attract domestic and foreign capital to Israel. Currently in force is the 68th Amendment ratified in 2010, which includes tax incentives for research and development activities. In the field of research and development activities, enterprises that meet one of the following conditions can be identified as a special priority: Firstly, the gross annual revenue is not less than 15 billion new shekels; secondly, the merged balance sheet is not less than 20 billion new shekels; thirdly, the business plan includes one of them: spending as little as 150m shekels on research and development in the country's heartland; Investing a minimum of 100 million shekels in national priority zones; The minimum number of employees reached 500 in the national central area or 250 in the national priority area. In addition, Israel has developed different incentive mechanisms based on the different characteristics of initial research and development companies, transnational groups and research institutions. To encourage individual investors to invest, the Israel’s "Angel Bill" (2011-2015) provides tax incentives specifically for individuals in private residential enterprises. Eligible target companies could receive tax benefit for three years, while allowing the capital they invest tax to offset their taxable income. The "Angel Bill Amendment" (2016-2019) adds new identification indexes of early R&D enterprise whose main source of income must be R&D activities and possesses intellectual property rights, and the companies have the ownership of their products. The adjusted identification standards pay more attention to the actual operation situation of the enterprises and improve the operability and pertinence of the policy. In 2017, he Israeli ministry of finance implemented a new round of innovation incentive program specifically for intellectual property enterprises. Under the new plan, Israeli companies with combined global revenues of more than 10 billion new shekels would be eligible for a 6 per cent tax credit, subject to any of the following conditions: Firstly, at least 20% of employees are engaged in research and development activities; Secondly, equity has received a capital injection of 8 million new shekels; Thirdly, the average growth rate in sales or personnel growth over the past three years is 25%. At the same time, the Israeli Finance Committee gives relevant supporting provisions to the enterprises recognized by the Innovation Bureau to ensure that enterprises enjoy a tax preferential up to ten-year period.

4. Education and talent introduction system
The enlightenment of Israel's environmental education comes from the belief of the Jewish nation. In the core spirit of godliness, the Jewish people respect the right of animals and plants to grow sustainably in plants [6], and Israel's environmental education comes along with the establishment of the state. Israel’s "Compulsory Education Law" promulgated in 1949 clearly states that students should be taught to respect the natural environment, the land and the surrounding landscape. The "National Education Law" promulgated four years later emphasizes that students should be encouraged to participate in environmental protection activities, further clarifying the status of environmental education in the national education system. In 1992, under the guidance of the UN's "Agenda 21", Israel decided to make environmental protection education a core part of the national strategy [7]. In 2004, the Israeli Ministry of Education issued the "Standard Document" for Israel's Sustainable Development Education Curriculum based on the "Israel’s Sustainable Development Strategic Plan", which was implemented by many schools. In 2010, the Israel Environmental Policy Center issued the "2030 Sustainability Outlook: The Future of the Israeli Environment" document, which states that long-term and stable public policies should be adopted to meet the needs of Israel's environmentally sustainable development. In the environmental bulletin issued by Israel in 2015, it is
ESMA 2018

IOP Conf. Series: Earth and Environmental Science 252 (2019) 042120
doi:10.1088/1755-1315/252/4/042120

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proposed to promote the restoration of ecosystems by vigorously developing environmental protection education, and to place environmental protection education in the status of protecting citizens' rights to obtain a healthy and safe environment. In the new historical period, Israel's environmental education has run through the entire public-school education system and presents diverse characteristics [8].

Israel's highly skilled talent return policy dates back to the 1950s. In the early days of the founding of the country, the Israeli government began to attract well-educated Jews in Europe by providing work and living subsidies, and emphasized "Nationalism" and "Nationalism" as the philosophy of talent attraction policy [9]. In the 1960s, the Israeli government proposed "Reward High-Skilled Talents Back" as an important goal of government work for the first time, identifying and contacting students and teachers working at local universities through the newly established academic talent bureau of the Israeli consulate and persuading them to return to Israel. Since 1978, Israel's talent return system and discourse structure have undergone important changes, from the emphasis on "Ideology" reasons to the emphasis on the added value of return from the perspective of individuals or families. Since the 1990s, due to the shrinking budget of the relevant department in Israel, Israel has changed its previous broad definition of talents and relatively loose acceptance standards, and Israel's high-level talent attraction policy has entered the stage of targeted positioning. The "60th Anniversary Regression Plan" in 2008 also changes the relatively loose and wide target positioning in the past and this project plans to change the imbalance of returning Israeli talent in 5 years [10]. In response to the increasingly fierce global talent competition and the changes in Israel's political economy and labor market, the Israeli government officially launched the "Israel National Initiative" in 2013 to provide a whole-process service for the Israeli immigrants and their families who have a strong willingness to return. In 2016, Israeli philanthropist Mori Mortimer Zuckerman invested $100 million to establish the "Zukman Science, Technology, Engineering and Mathematics Leadership Program" to attract Israeli scholars to return back and to encourage European and American researchers to teach in Israel.

5. Green financial system

In order to promote the rapid development of Israel's high-tech industry, the Israeli government promulgated the "Industrial Research and Development Encouragement Law" and the "Chief Scientist" system in the 1970s. Israel, which relies on technological innovation to promote economic development, has been struggling to improve in the field of venture capital. Many high-tech innovation companies are suffering from the follow-up of research and development funds. In this context, the father of Israeli venture capital (Yigal Erlich) applied for government funding to form a government entrepreneurship guidance fund and that was how the Yozma Fund emerged.

The Yozma fund is divided into two parts by the way of the parent fund: $80 million for equity participation in cooperation with international well-known financial institutions, with 10 private venture capital funds; 20 million dollars directly invested in high-tech startups [11]. Its key investment areas are communications, IT, life and biological sciences, medical technology, etc., with the focus on infrastructure construction and high-tech enterprises with patented technology. Yozma's operating model can be divided into three stages: funding, investment and exit. In the fund-raising phase, the Israeli government contributes 40%, and domestic private or foreign institutions contribute 60%. Both parties should assume corresponding obligations through the limited partnership, and employ a professional management team to be responsible for the investment asset management. During the investment phase, the government does not directly intervene in the daily operations of the companies it invests in. Introducing the high-quality management team from other countries can provide guarantees for the success of Yozma, as well as impart advanced investment management experience. In the exit phase, the Yozma Fund allows private sector investors to buy the government's share in the sub-fund for the five years of the fund's closure period at a government funding cost plus a 5%-7% interest rate. In this way, the Yozma Fund provides a strong appeal to professionals with relevant investment experience and facilitates the introduction of government funds. The essence of Yozma's parent fund is guidance, support and supervision. Through the leverage effect, it effectively guides private capital into the field of venture capital. Since its launch in 1993, the Yozma Fund has boosted
the entrepreneurial investment industry in Israel as a booster, playing a role as a market maker for a large number of Israeli companies succeeding in IPOs on the Nasdaq market. Yozma promotes the positive interaction of various institutions related to the venture capital industry and accelerates the process of advanced experience in foreign investment funds management, which makes it a model for other countries to imitate, and makes Israel a strong country in the world of venture investment and innovation and entrepreneurship.

6. Scientific and Technical system
Israel has a sound science and technology planning system that promotes the transformation of scientific and technological achievements at different levels from countries, regions, enterprises and universities. From the analysis of the three main subjects of government and industry: first of all, the Israeli government ensures that the national science and technology development strategies are in line with international standards, and constantly committees to maintaining close cooperation with other countries to obtain international funds. Second, enterprises build high-tech companies by attracting international talents. The third is that the Israeli universities and scientific research institutes use the government's international cooperation funds to research and develop advanced scientific research equipment, and then connect with enterprises to transform scientific and technological achievements. In order to improve the research and development level of university scientific research achievements, the "Magnetic Plan" provides funding for international frontier high-tech projects for a period of three to six years, with a budget of 66%. Under the "Small Magnet Project" project, a university and an enterprise are required to form a small joint research and development body to undertake the research and development of applied projects. The project grants to approve consortia for up to two years with up to $800,000.

With the acceleration of the globalization process and the limited land area and human and material resources of Israel, Israel has also begun to attach importance to international exchanges and cooperation to promote the process of technological innovation. The Israeli government mainly carries out international cooperation and exchanges in scientific and technological innovation through the signing of bilateral scientific research agreements, the establishment of bilateral research funds, and participation in the European Science and Technology Development Program. The bilateral scientific research agreement should be approved and signed by the Ministry of Foreign Affairs, and then the Ministry of Science and Technology is responsible for the specific implementation. In recent years, Israel and China have had frequent interactions in the field of scientific and technological innovation. In 2015, the first meeting of the joint committee on innovation cooperation was held in Beijing, China. China and Israel reached consensus on the China-Israel Three-Year Action Plan for Innovation Cooperation (2015-2017). The establishment of a bilateral research fund refers to the joint research and development through international cooperation funds and bilateral agreements, and provides 50% of financial subsidies for enterprises with outstanding contributions. The Multinational Industry Research and Development Fund (BIRD), established by Israel in cooperation with the United States, is Israel's first bilateral cooperation fund. Similar funds include Israel-Korea KORIL Fund, Israel-Singapore SIRRD Fund, Israel-Canada CIRDF Fund, and so on. The EU Research and Technology Development Program is the most important research cooperation program in Europe, and Israel is the first non-European country to participate in the program [12]. Under the plan, Israel actively convened international conferences to promote the exchange of scientific research personnel. The project leader designated by the treaty country can find potential partners to connect with science and technology innovation projects to jointly promote the scientific and technological innovation level of the treaty countries.

Acknowledgments
This work was financially supported by “Ministry of Education in China Youth Foundation Project of Humanities and Social Sciences (18YJC790092)”; “Chongqing Social Science Planning Project (2017YBJJ034)” fund.
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