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Original Research

Towards Sustainable Growth in the Textile Industry: A Case Study of Environmental Policy in China

Chen-ke Xu*, Hua Cheng, Zhong-ju Liao

School of Economics and Management, Zhejiang Sci-Tech University, Hangzhou, P.R. China

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Abstract

As an energy- and carbon-intensive sector, the textile industry has been the subject of many environmental policies. It has been under rigid regulation to promote energy conservation and emissions reduction in China, and a few scholars have carried out longitudinal and comprehensive studies of environmental policies aimed at the industry. This paper tries to fill in this gap by systematically analyzing the major environmental policies in this industry in China – the world's largest exporter of textile products. For the purpose of ensuring the accuracy and reliability of this research, 118 textile environmental policies from 1989 to 2016 at the central government level have been studied by employing content analysis, including command and control instruments, market-based instruments, and voluntary instruments. The following conclusions were derived:

1) The textile environmental policy system is stabilizing in China, and water pollution is the key treatment objective.
2) Most policies regulate textile manufacturing, but environmental issues are not effectively regulated at the consumer stage.
3) The imbalanced structure of policy instruments reflects the government serving as the main driver of textile environmental protection, and efficiency and flexibility need to be improved to form an integrated textile environmental policy system.

Keywords: textile industry, environmental policy, sustainable growth, content analysis, China

Introduction

As the largest developing country and exporter of textile products in the world, China is simultaneously facing severe challenges relating to energy resources and environmental constraints, such as the inefficient use of resources, high energy consumption, and serious pollution. The textile industry is one of the most important parts of the national economy in terms of product quantity, the implied workforce, and the value of the exports. Meanwhile, energy consumption by the industry accounts for approximately 4.3% of the total consumption of China's manufacturing [1]. Against the background of increasingly scarce energy resources and the need for sustainable growth, China's textile industry

*e-mail: chenke.xu@outlook.com

faces considerable energy constraints [1] and needs to be transitioned toward sustainability.

The textile industry, as one of the most energy- and carbon-intensive sectors, exploits large amounts of chemicals, water, and fossil fuel in its manufacturing process, which yields soil, noise, water, and air pollution [2]. In order to solve these energy and environmental pollution problems, various effective policies should be implemented by the government [3]. Textile manufacture of must be strictly controlled [4]. The textile industry has been the subject of numerous environmental regulations (exemplified by the directive for the Integrated and Pollution Prevention and Control, IPPC) and voluntary and administrative instruments relating to various environmental problems [5].

In China, the textile industry has been under rigid regulation for decades since the reform and open-up policy. Control and regulatory instruments are seen as the most efficient type of policy in China because of the long execution period [6]. The government has paid great attention to environmental issues arising from the country's population growth and economic development [1]. In recent years, the Chinese government has actively promoted energy conservation and emission reduction in the textile industry [1]. A number of laws, regulations, and policies such as the Guideline for Printing and Dyeing Enterprises [7] have been developed and implemented so as to promote sustainability in the textile industry. A call for "Ecological Civilization" proposed by Chinese President Xi has pushed forward environmental protection legislation and established laws governing water and air pollution [8]. The textile industry was listed as one of the pilot industries aimed at creating an ecological civilization in 2014 [9]. How are these ambitions realized in practice? Some scholars point out that since there is not enough publicity for cleaner production from the Chinese government, some enterprises have failed to understand the essence and have overlooked the key objective [10]. Similarly, Chang et al. [11] found that in China, the lack of promotion and incentives from government bodies is one of the most crucial barriers to the extensive implementation of green roof features in buildings. Therefore, it is very important to improve the communication and effectiveness of environmental regulation through overall understanding of it [12].

In recent years, research into environmental regulations has attracted many scholars' attention. Lavee and Joseph-Ezra [13] studied development and use of economic instruments in environmental policy by Israel. Peng and Liu [12] conducted a comprehensive analysis of cleaner production policies in China, specifically looking into the development process and then exploring their characteristics. Some researchers have examined the effect of environmental regulation on textile enterprises, for example, Atilgan [14] looked into environmental regulations in the European Union and their effects on the Turkish textile industry. Skinner et al. [15] investigated social and environmental regulation in rural China. They looked into the changing role of local government in the regulatory process, and featured a case study of Huzhou Municipality in Zhejiang Province. As to environmental issues relating to the textile industry in China, Lin and Zhao [1] studied the technological progress and energy rebound effect in China's textile industry, and summarized its policy implications. Zhu and Hu [16] observed the low-carbon and environmental protection of textiles and garments in the country, particularly analyzing the pollution of the textile and garment industry in the process of textile and clothing production and sales.

Ever since the late 1960s, as environmental quality and sustainable resources have become issues of political concern, policymakers have been seeking instruments suitable for achieving their objectives [17]. Environmental policy is explicitly aimed at treating negative externalities originating from economic activities [18]. Labandeira and Loureiro [19] identified three generations of instruments within environmental policy: command and control; economic, market, or flexible instruments; and voluntary agreements. Similarly, Rogge and Reichardt [20] identified three primary instrument types: regulation, economic instruments, and information. This research categorizes environmental policy instruments into three types: command and control instruments, market-based instruments, and voluntary instruments.

Command and Control Instruments

The regulatory instrument is comprised of the enforcement of laws and regulations setting objectives, standards, and technologies that polluters must meet [21]. They also imply a monitoring system to control polluters and economic and/or penal sanctions if not fulfilled [22]. Although industry is accustomed to comply with these "command and control" regulatory standards and performances of industrial waste treatment, these regulations have been less effective in controlling the problems of gross pollution and reducing future liability [23]. Command and control instruments usually take the form of bans, norms, market entry permits, emission limits, technical requirements for intermediate and/or final products, quota, specification of the characteristics of technical production processes, and decontamination.

Market-Based Instruments

The use of market-based instruments is to gain momentum and rapid expansion in OECD countries, since they can often complement regulatory instruments – increasing policy effectiveness and achieving environmental objectives at a lower cost [24].

Market-based instruments encourage behavioral change through market signals in the form of the modification of relative costs, financial transfer, or both, ranging from tradable permits and pollution taxes to

deposit-refund systems and performance bonds [25-26]. By the use of market signals, these instruments incentivize enterprises and individuals to make the trade-off between cost and benefit, and voluntarily reduce the environmental treatment costs associated with adopting new energy or technologies. Bernstein [27] proposed that pollution charges, market creation, subsidies, deposit-refund systems, and enforcement incentives are major instruments of this type, in which enforcement incentives refer to economic measures related to direct regulation. Thus this type of instrument may be viewed as a regulatory support measure rather than a purely economic tool.

Voluntary Instruments

Voluntary instruments try to increase flexibility by self-regulation of polluting sectors through a cooperative process [22]. Public administration establishes a scheme for environmental performance where those agents that comply voluntarily are given technical assistance, public recognition, or a more favorable normative treatment [22]. The creation and provision of information processes about the environmental damage caused by polluters are established by the public administration in order to guide and incentivize polluters to modify their performance. Voluntary approaches have become part of a more diverse instrumental toolbox in German environmental policy [28]. Zhang et al. [8] pointed out that government at various levels in China has endeavored to enhance moral education and boost public participation in environmental protection. The government has set up hot-lines for environmental pollution complaints. Residents can also complain by letter or interview about infringements of their environmental rights [8].

Based on previous research, many scholars have explored environmental policy in terms of its effect on technological innovation in textile enterprises and their environmental activities, investigating the optimization of the policy mix for enterprises. Although the textile sector has significant energy consumption, a few research papers performed longitudinal and comprehensive studies on the environmental policies of the textile industry [22]. There is so far no comprehensive research into environmental policies relating to the textile industry in China, and it is a great challenge to comprehensively and systematically analyze them. What's more, the design and timing of policy interventions is crucial for reducing innovation barriers and improvements in energy efficiency [29]. Factors of policy style, such as the stringency of design and the mix of different policy instruments, trigger enterprise decisions in favor of innovation and abatement activities [30]. Therefore, it is highly important to proceed with deeper explorations into environmental policies and give the corresponding advice for governments in developing countries to optimize their policies relating to the textile industry and facilitate sustainabile development.

This paper tries to fill in the gap via systematic analysis of the major environmental policies in the textile industry in China, and categorizing the elementary environmental policy instruments. Specifically four issues will be analyzed. First, what textile environmental policies have been published? Second, what kinds of policy instruments are adopted in textile environmental policies? Third, how to build up a policy analysis framework based on the connection among those policy instruments, and what are the underlying meanings? And fourth, how to analyze the current textile environmental policy system via this textile policy analysis framework?

Material and Methods

Content analysis is defined as the systematic interpretation of textual, visual, or audible matter such as newspaper editorials, television news, advertisements, public speeches, and other verbal or nonverbal units of analysis [31-32]. It can transform the qualitative symbolic contents into systematic quantitative data [33], and meaningful patterns are found from various kinds of information, helping people extract the essence from phenomena [34]. This research is mainly of an inductive nature. Context analysis of government policies helps the policy formulator and implementer clarify the essence of these policies, thus assuring their proper direction [35]. Therefore, content analysis is evidently the right method for conducting this research. Content analysis is normally undertaken with the following procedures according to literature [36], which are 1) select samples, 2) specify the analysis unit, 3) determine the category scheme, 4) judge and record, and 5) assess reliability.

Step 1: Select samples. Sample selection was conducted in a step-wise manner. Initially, environmental policies are collected at state level covering the full period and relating to overall environmental issues, from the beginning of 1980 to the end of 2016, not explicitly focusing on the textile industry. Thus, this study illuminates how central government works on environmental issues relating to the textile industry to support sustainability. Policies issued by local government have been excluded. All the policy texts collected are from public data. We searched central government and ministry websites, including State Council, the State Environmental Protection Administration, the National Development and Reform Commission, the Ministry of Finance, and other government websites. In addition, Wanfang Data Knowledge Service Platform contains the most complete special types of literature in the country, and the China Laws and Regulations Database is included. We use this platform to find the missing policies by searching for relevant keywords of environmental policy. Following that, we read through the policy collection

book China Environmental Protection Policies and Regulations Collection [37] in order to improve the completeness of policy collection. Altogether, we found 532 environmental policies.

All the collected environmental policy texts were read through to find the parts covering the textile industry. Keywords were then used to locate relevant texts within the documents, which are general environmental policy documents covering all fields. A number of keywords were used to avoid missing any relevant text, including "textile," "textile product," "textile dying," "fiber," "leather," "fur," "cotton," "silk," "wool," "knitting," "wasted textile product," and "wasted textile fiber." Relevant textile policies were collected and saved in separate documents. We found 180 environmental policies relating to the textile industry over the past 28 years, from the beginning of 1989 to the end of 2016.

Policies chosen must be in the form of law, regulation, opinion, measure, notice, or other document that represents government policy. After reading those initially collected textile environmental policies, we deleted several types of policy that contained just one or a few policy instruments, including categories, industrial standards, technology collection or diffusion, and government responses. In line with the overall collection and selection, we consulted several professors and doctors in textile research, and further adjusted and completed the final sample of textile environmental policies. Ultimately, 118 relevant textile environmental policies were obtained.

Step 2: Specify the analysis unit. A number of readings were made in order to gain knowledge of the content of the text. Initially, the policy texts were preliminarily organized into categories of policy instruments before a more nuanced analysis could be carried out. It was considered important to capture other dimensions of the textile industry in addition to instrument categories. Furthermore, each policy text tends to include various policy instruments. Thereafter, the coding (based on "policy number-order number") was conducted to specify the analysis unit. Overall, 349 analysis units were identified.

Step 3: Determine the category scheme. Content analysis commonly focuses on the manifest content, namely the content that is clearly pronounced in texts; however, interpretations of latent content can occur. The core feature of a qualitative content analysis is the creation of categories [34]. The initial way of categorizing elementary text relates to policy instruments, while qualitative descriptors of this category characterize the type of regulatory, market-based and voluntary instruments available. Due to the various perspectives associated with each type of policy instrument, only a limited number of instruments were selected as descriptors. Specifically, command and control instruments will be described by norms, permits, bans, restricted areas, usage restriction, and pollution treatment monitoring. Penalties, subsidies, environmental taxes, export tax reimbursement, and government purchase are descriptors of market-based instruments. Voluntary instruments include information publicity, environmental assessment and evaluation, technical innovation, moral education, public participation, and ecological areas/projects. Strictly speaking, the policy instruments category cannot reflect the overall characteristics of textile environmental policy, while the textile industry's regular pattern and character is vital in the creation of textile policy. Therefore, according to the technology life cycle and value chain, the progress of the textile industry can be viewed as taking place in four stages,

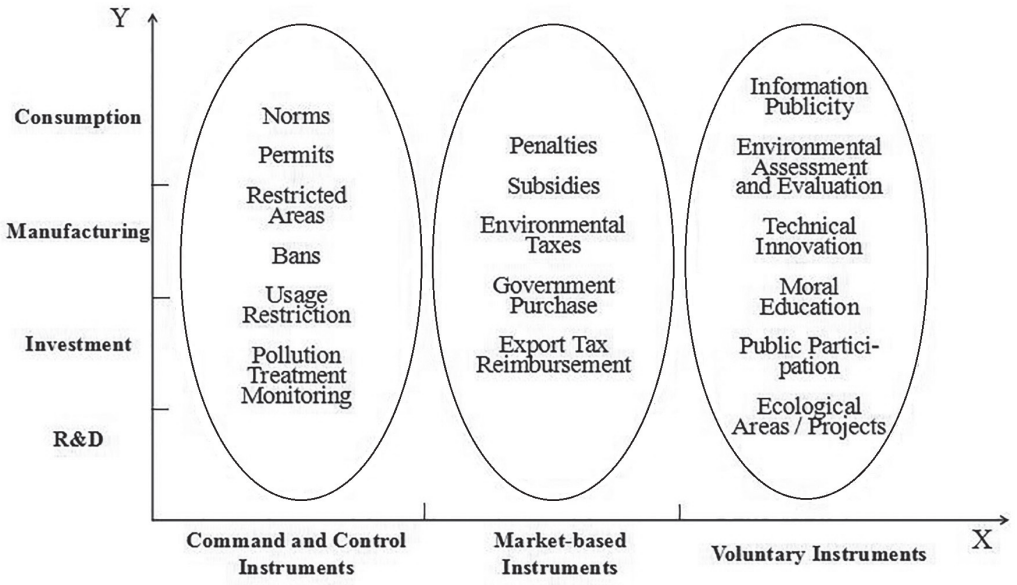

Fig. 1. Two-dimensional analysis framework of textile environmental policy.

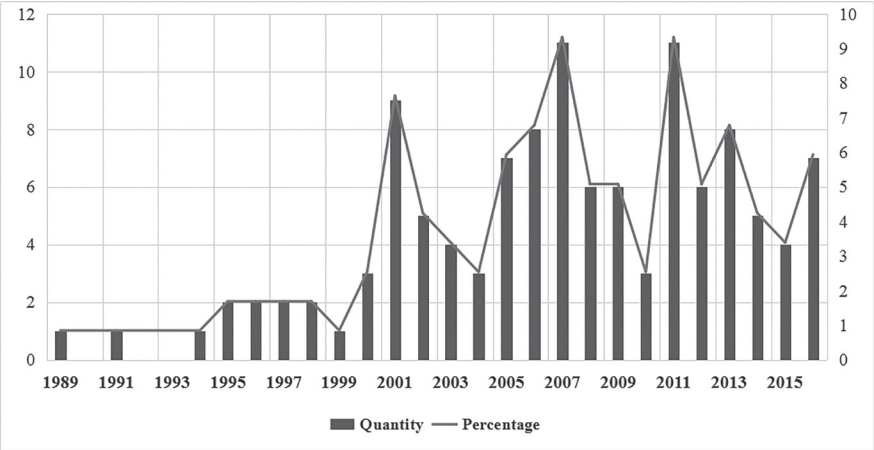

Fig. 2. Textile environmental policies evolutionary process.

including research and development (R&D), investment, manufacturing, and consumption. Different policies work at different stages of the value chain, leading to diverse effects. Thus, the industrial value chain is introduced as the second category. Based on the policy instruments and textile industry's characteristics, this creates a two-dimensional analysis framework of textile environmental policy, in which X dimension is policy instruments, and Y dimension is represented by the textile industrial value chain (Fig. 1).

Steps 4 and 5: Judge and record, assess reliability. In order to conduct in-depth research of all 118 textile environmental policies, based on previous research and clearly defined concepts, those policies are coded together with the other two experts in this field, who are invited to ensure the rigorous analysis and exclude the interference of subjective opinions. They determined the content validity to be one. After testing the consistency with the experts, the consistency coefficient is one.

Results

Policy Evolution

Generally, the number of Chinese textile environmental policies increased from 1989 to 2016 (Fig. 2). We identify three stages: the first stage of loose regulation from 1989 to 2000, the second is fluctuation from 2001 to 2004, and the third is strengthened regulation from 2005 to 2016. In the first stage, textile environmental policies issued each year were barely changing, and the number was 15, only taking up 12.71%. The most important policies during this period were Enforcement Regulations for Law on Prevention of Air Pollution of the People's Republic of China [38] and Marine Environment Protection Law of the People's Republic of China [39]. Since the open and reform policy in 1978, the textile industry has switched from following the planned economy to a market economy. The rapid development also gave raise to problems such as repeat construction and blind competition, which led to textile industry losses over several years. This situation turned conversely from 1998, after several years' structural readjustment and technical improvement, to 2000, when the whole industry stepped into the fast development stage. The standard-reaching rate of textile pollution emission targets remained low until 2001 – the year China became a member of WTO. To improve international competitiveness and catch up with global increasing need for qualified textile products, the central government strengthened environmental regulation of its industries. Technical Policy of Waste Water Pollution Control in Dyeing Industry [40] was issued in this year. During 2005-2016, the central government strengthened environmental regulation aimed at the textile industry and 82 environmental policies involving the textile industry were issued, which is 69.5% of all polices. From 2001 to 2016, textile environmental policies witnessed cyclical fluctuations, with a wave period of around 5 years. The spikes appeared in 2001, 2007, and 2011, in which National 10^{th}, 11^{th}, and 12^{th} 5-year Plans for Environmental Protection were enacted. Following each national 5-year plan for environmental protection a series of environmental policies emerged, in which the textile industry became governed with care and considerable effort as one of China's main industries. Although the evolving process of textile environmental policies fluctuates, the fluctuation in different waves has been decreasing, which means textile environmental policies are gradually stabilizing.

Policy Objective

The titles of 118 textile environmental policies have been analyzed in order to determine the policy objectives of the central government. The frequencies of key words are obtained. To start with, ineffective words are excluded, such as "about," "notice," and "organization," etc. Besides key words with similar underlying meanings like "ecologic," "recycle," "reclaim," "regeneration," and "green" are put into the

Table 1. High-frequency keywords in textile environmental policies.

Number	High-frequency keywords	Frequency
1	Environment	43
2	Pollution (water pollution, pollutant, source of pollution)	30
3	Protection, environmental protection	29
4	Supervision (examine, monitor, approve)	29
5	Energy-saving (high-energy consumption, saving water/energy)	25
6	Technology (high-tech, informatization)	16
7	Prevention and treatment	15
8	Emission	15
9	Enterprise, listed	14
10	Finance (loan, debt, (capital) fund, audit, reward, refund of duty)	14
11	Water quality (Yangtze River, The Three Gorges, Huaihe River, Taihu Lake, Chaohu Lake drainage basin)	13
12	Sustainability development (ecological, recycle, reclaim, regeneration, green)	11
13	Capacity, surplus	8
14	Wasted product/water	8
15	Resource, resource-oriented	6
16	Textile, dying	3
17	Structure	3
18	Atmosphere, gas	2
19	Clean production	2
20	Electric energy	1

same category, and key words are combined, such as "high-energy consumption" and "energy consumption." This produced a table of keywords with high frequency in textile environmental policies (see Table 1).

Among these textile environmental policies, the top 20 high-frequency keywords are closely related with environment, pollution, protection, supervision, and energy saving. Textile policies issued by the central government mainly aim at environmental protection, solving pollution issues, and enhancing government supervision. In comparison, energy saving is a less important objective. Meanwhile, the central government makes considerable effort to improve technology and control intensive emissions. Sustainability is one of the main objectives of textile development. Due to the excessive use of sources, the textile industry produces various types of waste including mainly wastewater, solid waste, gases, and heat emissions. Wastewater from textile plants contains significant loads of organic matter, salts, and color [41]. It can be seen from the above table that the Chinese government treats the problem of water pollution seriously, which is consistent with the findings of Ozturk et al. [41]. However, progress with regard to air quality was limited, and solid waste treatment gets even less attention in policies. In order to achieve sustainable growth of the textile industry, waste flue gas, heat emissions, and solid wastes should be taken into serious consideration and handled properly to avoid further detrimental environmental pollution problems.

Analysis of Policy Instruments

Through in-depth reading, 349 elementary analysis units of Chinese textile environmental policies are classified into different categories of policy instruments. During the analysis process, their corresponding development stage in the textile industry is also identified. This produces the 2-dimensional distribution diagram of textile environmental policy instruments (Fig. 3). Overall, the 118 textile environmental policies including 349 elementary texts cover command and control instruments, market-based instruments, and voluntary instruments, plus all stages of the textile industry. The central government has adopted various measures to motivate and regulate the textile industry's environmental activities so as to achieve sustainable development.

Fig. 4 shows the analysis result of textile environmental policy instruments. As we can see,

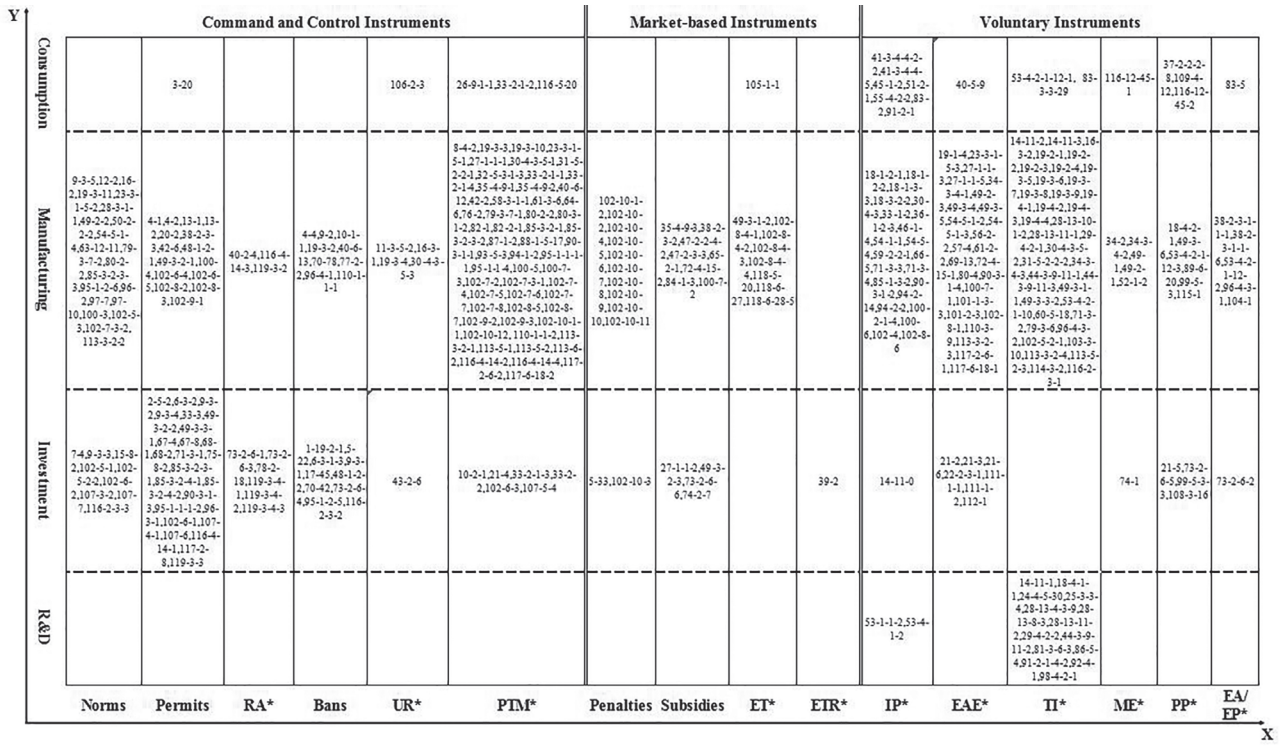

Fig. 3. Two-dimensional distribution diagram of textile environmental policies instruments.
*Abbreviations: RA: Restricted Areas, UR: Usage Restriction, PTM: Pollution Treatment Monitoring, ET: Environmental Taxes, ETR: Export Tax Reimbursement, IP: Information Publicity, EAE: Environmental Assessment and Evaluation, TI: Technical Innovation, ME: Moral Education, PP: Public Participation, EA/EP: Ecological Areas/Projects.

among all three types of policy instruments, command and control instruments have been used most frequently, accounting for 48.71%, while voluntary instruments are 41.56%. The least part goes to market-based instruments, which only comprises 9.75% of all textile environmental policy instruments. In command and control instruments, pollution treatment monitoring (38.24%), permits (24.12%), and norms (17.65%) are the most common instruments used by the central government, and altogether account for 80% of this type. As to voluntary instruments, technical innovation (36.55%) has arisen, encouraging enterprises to adopt

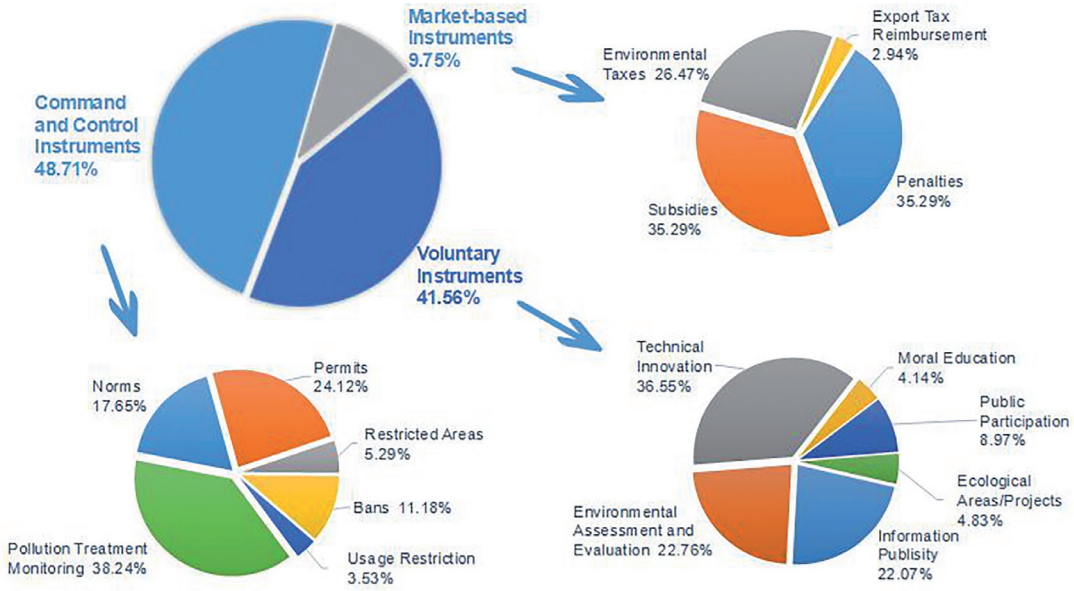

Fig. 4. Textile environmental policy instruments percentage.

new technology. Environmental assessment and evaluation (22.76%) as well as information publicity (22.07%) also represents a proportion, while public participation (8.97%) and moral education (4.14%) are not emphasized much in textile industry environmental protection. However, for this industry, which is so closely connected to every citizen, it is highly important to educate individuals and enterprises to realize the importance of sustainable growth and create different channels for citizens and enterprises to be part of the green movement. In terms of the latter type, market-based instruments, it only accounts for 9.75% of all three types. In addition, apparently, the central government did not provide enough flexibility for the polluters by using market-based instruments, which only accounts for 9.75% of all instruments. In this type, penalties and subsidies are equally utilized (both are 35.29%), followed by environmental taxes (26.47%). Government purchase was listed as one instrument in the category scheme session, while none was found among the 349 elementary policy texts. There is considerable room for improvement for the central government in terms of control of textile environmental issues.

In order to determine the central government's attitude toward textile environmental development, we analyzed the frequency of elementary policy texts at different stages of the textile value chain. The central government has issued policies that cover the textile industry's overall development stages, including R&D (4.58%), investment (22.35%), manufacturing (67.05%), and consumption (6.02%). There are only 16 policy texts on the R&D stage, and 21 elementary texts related to consumption. Government's focus on textile industry environmental issues is mainly on the manufacturing stage, during which most environmental problems arise, and much less on the consumption stage. Recycling programs implemented in recent years demonstrate increasing awareness in this direction, for example the "Worn Clothes Zero Discard" program organized by the Bureau of Civil Affairs and the China National Textile and Apparel Council in 2014. A growing number of individuals, institutions, and enterprises now participate in the recycling and regeneration movement. It is necessary to issue more environmental policies to regulate textile and apparel consumption.

Discussion of Results

Current environmental policies provide stimulus for the Chinese textile industry to transit toward sustainability. Although the textile policy evolution process shows that government attaches great importance to environmental issues, mismatches between environmental regulation and ecological dynamic processes can cause unintended consequences, and possibly drive resource users to look for loopholes in the law [42]. Challenges related to these policies still exist.

The basic environmental problems in the textile industry relate to its chemical load and the amount of waste water produced. Other main problems are energy consumption, air emissions and solid waste products [14]. In the EU, air emissions from the textile industry have been controlled for a long time [14]. Nonetheless, in Chinese policies relating to the textile industry, water pollution and emission treatment has received much more attention than other important issues, such as solid waste, gas, and heat emissions. According to the statistics of China, emissions from textile mills have increased from 70,000 tons in 2001 to more than 190,000 tons in 2011, with exhaust gas yielding serious harm to the atmospheric environment [16]. Policies should be implemented to regulate environmental problems comprehensively, and further achieve an "ecological civilization." Besides, clean production and use of new energy are not addressed in those textile policies at the moment. This is vital for the sustainable growth of the textile industry in China and other emerging economies. Although post-purchase recycling, which is essential for achieving sustainable development, has been discussed extensively in literature and implemented broadly in developed countries, such as the European Union and United States, currently textile environmental policies addressing the consumption stage only account for 6.02% of all environmental policies in the country. In line with the NDRC [43], waste textile production in China in 2013 was about 20 million tons, and the comprehensive utilization rate of waste textiles was only 15%. Supervision of post-purchase recycling needs to be strengthened in textile environmental policies. This should be a true national movement that needs the participation of textile enterprises and citizens to achieve sustainable growth.

Although there is a general change in China's environmental management, which is the shift from conventional command-and-control regulations to instruments using incentives [44-45], it is argued in this study that the proportion of the three major instrument types – command-and-control instruments, market-based instruments, and voluntary instruments – is uncoordinated in textile policies. Liu and Wang [46] pointed out that regulatory measures have been applied earlier and more widely than market-based policies for promoting energy conservation and emission mitigation in energy-intensive sectors in China. This study shows that almost half (48.71%) of the textile policies are command-and-control instruments. Apparently, the coordination effect of these two types of policy instruments has not performed well in the textile industry in China.

In the category of command and control instruments, pollution treatment monitoring is most frequently used (38.24%). Overall, this high proportion pinpoints the failure of the implementation of previous policies. It is difficult to make sustainable progress if this situation continues. A mix of other types of policy instruments

must be balanced in order to form an integrated textile policy system.

So far as market-based instruments are concerned, the analysis results show that both penalties (35.29%) and subsidies (35.29%) are equally implemented in the textile industry. Hicks and Dietmar [47] pointed out that special funding for SMEs is provided in China to better integrate sustainability into practice. However, this type of funding is not identified in environmental policy relating to the textile industry. Our study reflects that new technology, clean production demonstration projects, and major pollution control projects in drinking water source areas are subsidized. For the purpose of encouraging sustainable practices, more easily accessible funding should be offered to textile SMEs. Furthermore, the previous study acknowledged that the price for polluting emissions provides flexibility for polluters [22]. Out of the variety of instruments, eco-taxes and emissions trading system are most relevant in the environmental field [48], which are available in many OECD countries for reducing pollution [49]. However, only four elementary text units about polluting emissions trading have been identified. Similarly, Israel lacks the use of greenhouse gas emissions trading and carbon taxes as well [13]. These two economic instruments should be adopted further in environmental policies at a central level to offer flexibility for polluters. In general, textile enterprises receive limited financial support and little economic flexibility in treating environmental issues.

Although voluntary instruments account for a large proportion (41.56%), its imbalanced structure reflects limited public participation. Technical innovation reaches 36.55% in voluntary instruments. Among all the 25 policies surveyed in this instrument, 11 are in the form of a plan, which serves as a guideline and for goal setting, and the rest are opinions and notices with low policy stringency. Since the stringency of policy design and the mix of different policy instruments trigger the enterprise's decision making in favor of innovation and abatement activities [30], the stringency of technical innovation instrument needs to be increased, and more specific technical assistance should be provided to encourage those textile enterprises that comply voluntarily [22]. Firms tend to perform more efficiently in environmental information disclosures when they receive enough institutional support [50]. The education of citizens for the benefit of increasing ecological awareness should be the fundamental element of effective integration of environmental, economic, and social function [51]. However, this study indicates that environmental assessment and evaluation, information publicity, and ecological area/projects, as top-down instruments, occupy a total of 49.66% of voluntary instruments. Conversely, public participation and moral education, as bottom-up instruments, only account for 13.11% in the voluntary category. It is well recognized that bottom-up instruments are important for the self-regulation of enterprises [22]. Rising environmental awareness may activate manufacturers' demand for ecological methods so that the competitive power of enterprises increases [14]. Apparently, moral education needs to be enhanced. Besides, only one policy about public supervision has been identified in textile policies. There should be more opportunities for the public to participate in textile industry environmental protection initiatives. The greater the number of role-players involved and the greater the independence amongst them, the better the performance potential of the environmental enforcement effort [52]. Only one policy about exploring the new mode of innovative environmental service was identified, which shows that the effect of technology support and collaboration in the textile industry remains undiscovered. Innovative environmental initiatives need to be further promoted by issuing follow-up policies to improve the collaboration and effective diffusion of core and generic technology.

The dominant logic can be tracked through policy instrument choice and utilization. In the textile industry, at present the mode of regulation-inspection-treatment is adopted, and post-treatment monitoring instruments are much more frequently used than pollution prevention. The government is still the foremost driver behind textile industry environmental initiatives. Enterprises and individuals currently lack the required flexibility, and most environmental practices are more passively implemented than initially intended. The current structure of voluntary instruments cannot fully motivate the various parties and hinders long-term sustainable development. Social stress from associations and public supervision still remain a minor force, and moral education remains limited, which leads to weak environmental self-regulation among textile enterprises.

We suggest that central government should cut off the usage of command and control instruments and switch to instruments that trigger more flexibility and initiative. Baynham and Stevens [53] conducted an evaluation of official community plans in British Columbia in Canada, and found that less than half the plans had timelines and actions for monitoring. A similar situation exists in the textile industry in China. Effective monitoring and evaluation strategies can closely track progress toward the target and make adjustments as necessary [53]. The mix of instruments needs to be recognized by its target groups and adopted in order to ensure energy-efficient technology, service, or behavior diffusion [54]. Therefore, communication networks between organizations and an integrated environmental management system need to be enhanced to improve the textile enterprises' understanding of environmental policy. As the world's largest textile manufacturer and exporter, the Chinese textile industry's transition toward sustainable growth is vital to the rest of the world. The selection, adoption, and use of the correct or optimum mix of enforcement tools to suit specific conditions and requirements are essential to ensure an efficient and effective enforcement regime [52].

Conclusions

In this study we comprehensively analyzed textile industry environmental policies in China from the past 28 years (1989 to 2016) at the central government level. The policy evolution process shows that after the loose control stage from 1989 to 2000, textile environmental policies fluctuate along with the rapid growth of the Chinese textile industry, and the fluctuation in different waves has been decreasing, reflecting the stabilizing textile industry environmental policy system. The analysis of policy objective reveals that water pollution is the key treatment target at the moment, while other major textile pollution, such as solid waste and soil and waste gas pollution, need to be emphasized to form an integrated policy system for the textile industry. By using content analysis, we introduced the 2-dimensional analysis framework combining policy instrument types and stages of the textile value chain. Textile environmental policies issued at the central level cover all stages of the value chain, including R&D, investment, manufacturing, and consumption. A majority of polices issued so far regulate the manufacturing stage, and limited polices relate to the consumption stage. In terms of policy instruments, command-and-control instruments are mostly being adopted, market-based instruments play the least part, and the structure of voluntary instruments is unbalanced. After analyzing specific instrument adoption in each type, we put forward the textile environmental policy suggestion.

Research Implications and Limitations

Compared to previous studies, this research contributes to the comprehensive understanding and evaluation of textile environmental policies in China. It is essential to find the underlying rules of textile environmental policies and explain how these policies influence textile enterprises' environmental initiatives, and reveal the various roles played by different policy instruments in the textile enterprises' environmental practices. Our study shows that the policy setting and characteristics largely influence the effect of textile industry environmental policies, and may deepen textile enterprises'understanding of their essence.

The present study leaves much space for further research. It explores the evolutionary process, but does not analyze collaborations between institutions. The analysis has been conducted from the perspective of policy-maker, while the implementation effects are merely discussed. Differences in the policy context, stakeholders, lobbyists, and policy communities often have an important influence on the actual design and from time to time succeed in diluting the environmental policy instruments [55]. In terms of future studies of textile industry environmental policies, we suggest that comparative studies on environmental policies may be conducted to find more evidence of the effectiveness of different policy approaches.

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