

# Corporate Social Responsibility in the Wood-Based Panel Industry: Main Strategies from Four Enterprises in China

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## Abstract

With economic globalization and the diffusion of corporate social responsibility (CSR), firms are increasingly moving from using reactive to more proactive strategies in their environmental, social, and governance (ESG) strategies. Wood-based panel processing enterprises, which are particularly sensitive to environmental and social issues, are increasingly developing their CSR strategies. Previous research on environmental protection and responsibility in this industry focused mainly on single aspects, such as the control of volatile noxious gases, while neglecting comprehensive social environmental responsibility strategies, especially in emerging economies. This article adopts a case study approach that analyzes the main CSR strategies of four leading Chinese wood-based panel processing enterprises. The study provides a reference for similar enterprises in China and other developing economies on CSR/ESG strategies. Even though context specific, our findings can provide further impetus for research and discussion on other emerging economies that share similar institutional characteristics.

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The past two decades have ushered in a surge of corporate social responsibility (CSR) campaigns across the globe, referred to as the CSR era (Cohen et al. 2014). With economic globalization and the continued development of the CSR activities (Gritten et al. 2012, Toppinen et al. 2016), the understanding of and research on CSR strategies and their implementation have become deeper and broader (Rhee and Lee 2003, Garriga and Melé 2004, Dahlsrud 2008, Kovács 2008).<sup>1</sup>

CSR has emerged as one of the most debated topics for both business practitioners and scholars (Cohen et al. 2014, Lu et al. 2015). The forest sector is a particularly interesting example for what concerns the development of CSR. Since the beginning of the 21st century, the forest industry has

been confronted with the need to meet the increasing demand for resources, to reduce pollution and emissions, and to contribute to sustainable forest management (SFM).

In addition to resource scarcity, public concern has grown with regard to environmental issues and, consequently, environmentally friendly products (Tuppura et al. 2013, Toppinen et al. 2014, Korhonen et al. 2016, Pätäri et al. 2016). Therefore, reaching and maintaining legitimacy, derived as business behavior against societal expectation, has become an increasingly important motivation for CSR (Panwar et al. 2014a, 2014b). This is also shown in that a

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<sup>1</sup> In Europe, CSR is typically defined as voluntary and going above and beyond requirements. However, other countries (e.g., the United States) and several scholars retain a different understanding of CSR that included also mandatory practices (Toppinen et al. 2016). Because CSR in China is at a very preliminary stage, this article adheres to the mandatory understanding of CSR (Noronha et al. 2013).

global trend in CSR reporting in the past decades has seen the progressive inclusion of a wider range of stakeholders and issues in addition to only shareholders' interests (Vidal and Kozak 2008).

Legitimacy has become especially critical in the context of emerging economies, such as China (e.g., Mikkilä and Toppinen 2008, Abeysekera and Lu 2014). While international companies are more subject to legitimacy pressures in emerging economies, domestic companies have to align their operations to increasing sustainability standards (Kim et al. 2015). Multiple drivers for sustainability have thus given rise to the need for enterprises to improve their social responsibility performance with regard to environmental protection and product safety.

The forest sector, in particular, has been identified to be among those to have direct impacts on environmental and social issues (Vidal and Kozak 2008, Toppinen and Korhonen-Kurki 2013, D'Amato et al. 2015). This has led to both challenges and opportunities, including emerging environmental awareness, optimization of energy and consumption, global changes in international environmental policies, industrial competition, and public relations management (Vihervaara and Kamppinen 2009, Hansen et al. 2014, Chen and Hao 2016, Toppinen et al. 2016).

CSR is thus pivotal to forest enterprises, an increasing number of which are committed to issuing sustainability reports and constantly improving their disclosure of sustainability-related information (Li and Toppinen 2011). Forest enterprises have also identified and tried to meet the social and environment issues through their management processes (Hansen and Juslin 2011). This indicates not only a transformation of public notions but also a shift from reactive strategies to voluntary adoption of proactive ones (Lozano 2013, Tuppurä et al. 2013).

Wood-based materials are used to produce various types of panels (Seo et al. 2015). By effectively utilizing woods and other plant fiber resources, the wood-based panel industry plays a fundamental role in addressing the gap between timber supply and demand (Zhang and Zhou 2005). According to related research and prediction (Goroyias et al. 2011, Qian 2011), the global annual growth rate of wood-based panels as surface decorative material has remained at 3 percent between 2011 and 2015, with the main growth contributors in developing regions in South America, eastern Europe, the Middle East, and especially Asia.

Despite growing economic importance, prior CSR research conducted on the wood-based panel industry in China has focused narrowly on individual issues, such as the control of noxious gases, such as formaldehyde (Zhang 2006, Liu and Zhu 2014). Instead, insufficient attention has been paid to the whole industrial process and the role of comprehensive CSR and environmental, social, and corporate governance (ESG) strategies.

This study intends to investigate CSR/ESG strategies of four leading enterprises from the wood-based panel industry in China. The analysis is based on combining several data sources, including interviews and surveys with company stakeholders and analyses of corporate sustainability reports. Although being context specific to China, our findings can provide further impetus for research and discussion in other emerging economies that share similar institutional characteristics.

## Contextual and Theoretical Background

### Development of CSR in the wood-based panel industry in China

China is both a major producer and a consumer of wood products. The growing social demand has created enormous opportunity for the forest products market (Zhang 2008) and the rise of new competitive strategies (Wan et al. 2015). However, China is also a country with a severe shortage of forest resources. Despite this, the wood-based panel industry of China is developing rapidly. In 2015, the sales volume of compound wood flooring and multilayered wood flooring was about 309.5 million m<sup>2</sup> (Fig. 1), accounting for about 81.4 percent of total sales (China National Forestry Products Industry Association [CNFPPIA] 2015b). Figure 2 shows an increasing trend of the output of the wood-based panel industry in the 2010 to 2014 period in China.

Such rapid development of China's wood-based panel industry has also been accompanied by problems. For example, some products contain excessive levels of formaldehyde, and some noncompliant enterprises have been afflicted by problems such as low efficiency of resource utilization, excessive levels of exhaust emissions, and water, dust, and noise pollution (CNFPPIA 2015a). The urgency of these problems has created some consumer bias against the domestic wood-based panel industry (Li 2015).

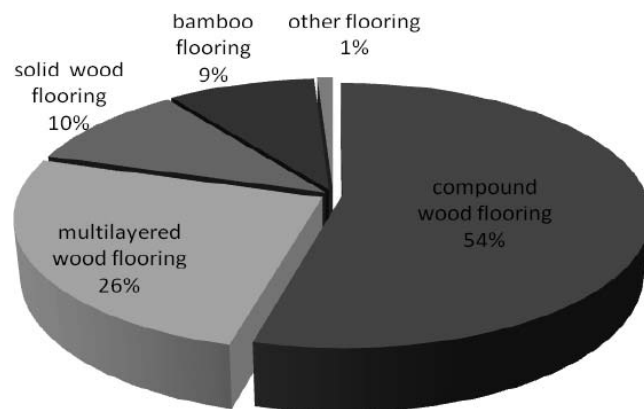


Figure 1.—Sales volume of floor ornamental panels in China, 2015 (China National Forestry Products Industry Association 2015b).

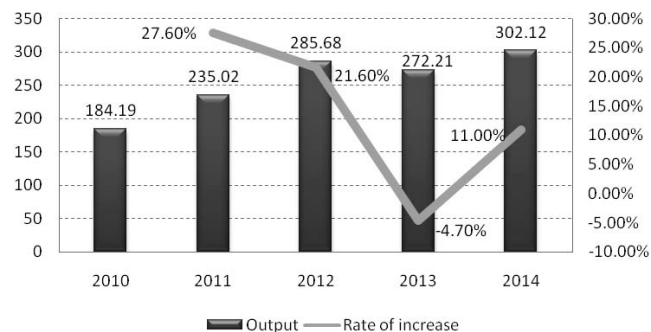


Figure 2.—Output of the wood-based panel industry in China, 2011 to 2014 (China National Forestry Products Industry Association 2015b).

International and Chinese guidelines relevant for CSR include the ones released by the International Organization for Standardization (2012), the Global Reporting Initiative (2013), the Chinese Academy of Social Sciences, the China Forestry Industry Federation (CFIF), and the CNFPIA. Currently, the Chinese government is actively advocating cleaner production (e.g., circular economy; Matthews and Tan 2011) as one part of fulfilling CSR. With the release of the latest GB/T29903-2013 “Technological Requirements for Cleaner Production in Wood-Based Panel Industry” (the Chinese Forestry Industry Association, 2013), stricter requirements were made on enterprises for energy conservation, emissions reduction, and comprehensive energy consumption. Note that in the same year, the output of the wood-based panel industry decreased (Fig. 2) because some enterprises were reorganized and transformed, and part of them even stopped production to meet the standard requirements imposed by GB/T29903-2013 (CNFPIA 2015b).

In the forest sector in China, CFIF and CNFPIA jointly issued the first industry standard for sustainability disclosure (CFIF-CNFPIA BZ 2011-01) in July 2011. This guide illustrates the responsibility content of forestry enterprises in environmental protection, low carbon production, energy conservation and emissions reduction, and ecological system service. Since 2012, CNFPIA has coordinated pilot enterprises to release CSR reports. There were 39 CSR-issued reports in the context of the wood-based panel industry by 2015. Meanwhile, the report guideline was amended to CFIF-CNFPIA BZ 2015-02. Wood-based panel enterprises are increasingly acknowledging the importance of CSR and undertaking effective strategies to respond to social and environmental challenges, thus gaining long-term competitive advantages in the industry.

### Theoretical framework of CSR/ESG strategies

In recent decades, the CSR concept has evolved “into a core business function which is central to the firm’s overall strategy and vital to its success” (Carroll and Shabana 2010, p. 93). Several approaches have been proposed in CSR/ESG strategies, such as cleaner production, environmental management systems, and eco-efficiency. These commonly target the production processes, management systems, and products and services of a firm (Thongplew et al. 2014). In the forestry industry, sustainability also refers to SFM. Disclosure of corporate sustainability information and related strategies and practices is considered important to maintain social license to operate because “it is a form of control which requires firms to meet society’s environmental exceptions” (Lynch-Wood and Williamson 2007, p. 322). In enhancing their competitiveness, companies should be more proactive in sustainability management and reporting comprehensively on all the sustainability dimensions (Husgafvel et al. 2013).

With the process in Figure 3 and acknowledging the trend of CSR/ESG strategies,<sup>2</sup> three stages can be distinguished

<sup>2</sup> Recently, there has been a tendency to prefer the term “environmental, social, and governance” (ESG) rather than CSR because the financial outcomes can be generated through ESG practices. Comparing CSR with ESG, CSR languages are more focused on the motivation and intentions, and ESG seems to focus more on the actions and results (Cohen et al. 2014, p. 361).

(Cohen et al. 2014). The framework of this study is summarized in Table 1 according to the types of CSR/ESG strategies present in the forestry industry. This framework is also useful into analyzing the CSR/ESG strategies of the case companies. Reactive strategies are mainly for meeting entry requirements through land use and management practices. These strategies are in response to external pressures to control risks. Responsive strategies are aimed at achieving operational effectiveness. These strategies are still fundamentally defensive but considered a long-term perspective. These include, for example, forest certification adoption and multiparty agreements. Proactive strategies include green products, green technologies, and new products. Firms develop proactive strategies to turn social and environmental issues into competitive advantages and gain market share and financial outcomes. Overall, reactive strategies are the bottom line (i.e., operating context), and proactive strategies are the top line (i.e., competitive context).

### Methods and Data

This article adopts a case study approach, analyzing data collected through questionnaires and semistructured interviews with relevant company stakeholders and through corporate disclosure documents. A case study is “the preferred strategy when . . . the focus is on a contemporary phenomenon” (Yin 2003, p. 1) that is not yet well explored in the existing literature (Silverman 2001). In particular, this approach allows a deeper analysis by integrating various data collection methods (documentation, interviews, and questionnaires) and data type (qualitative or quantitative) (Patton 1990, Eisenhardt 2007). A case study is characterized by a small sample, whereas a rich and rigorous methodological asset contributes to effectiveness and reliability and reduces the likelihood of a biased view (Patton 1990).

Our analysis includes four enterprises: Jilin Forestry Industry Group Co. Ltd. (FI), Huafun Forestry Group (HF), Dare Wood-Based Panel Group Co. Ltd. (DR), and Guangxi Sunway Forest Products Industry Co. Ltd. (SW). Characteristics of the interviewed companies are summarized in Table 2.

The four enterprises were selected for the following reasons. First, the companies were included among the 39 that released CSR reports in cooperation with the Chinese Forestry Industry Association. FI and SW have released

*Table 1.—Typology of corporate social responsibility/environmental, social, and governance strategies.<sup>a</sup>*

Stage (level)	Strategies
Reactive	Countering campaigns by environmental nongovernmental organizations through modified land use Countering campaigns by environmental nongovernmental organizations through management practices
Responsive	Forest certification adoption Multiparty agreements
Proactive	Green traditional products (environmentally and socially responsible lumber) Green technologies (energy cogeneration, waste treatment and carbon-neutral commitments) New products (biofuels, bioproducts, biochemicals)

<sup>a</sup> Adapted from Cohen et al. (2014, p. 363).

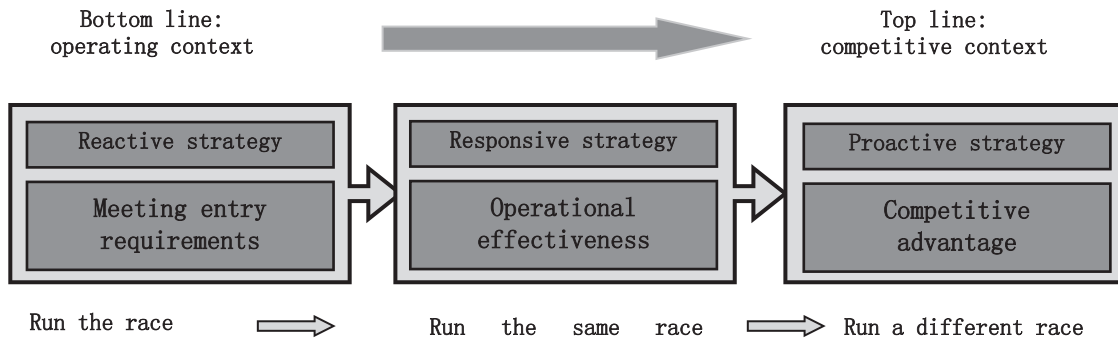


Figure 3.—Corporate social responsibility/environmental, social, and governance strategy process (Cohen et al. 2014, p. 361).

reports for 5 consecutive years, HF for 4 consecutive years, and DR for 2 years (years are provided in Appendix 1). All companies have received relatively positive assessments in terms of social responsibility fulfillment.

Second, the four companies are the leading enterprises in China’s wood-based panel industry with high product quality and brand influence in recognition (CNFPIA 2015a). Among them, FI and DR are the industry pacesetters in terms of enterprise scale and industrial technological innovation.

Third, with diversified characteristics and geographical background, all of the four companies can be seen as forest board-integrated enterprises. They operate in different parts of China: FI in northeastern China, with a branch in southern China; DR in southern China; and HF and SW in southwestern China. The four companies are representatives of the current wood-based panel enterprises in China. Among them, FI and HF are state owned, whereas SW and DR are privately run.

Open-ended questionnaires were administered to high-level executives, mid-level managers, and ordinary employees. We obtained 40 responses, 10 from each company. Corporate leaders, executives, mid-level managers, and employees were selected as respondents by quota sampling and snowball sampling. The questionnaires were aimed at eliciting the respondents’ knowledge on issues regarding their own company on the CSR strategy and performance and the areas for strategy improvement. The questionnaires were then followed by 37 industry interviews. The interviews focused on confirming and deepening the information elicited through the questionnaires. To guarantee the completeness and objectivity of the research, we also interviewed two experts from the Chinese Forestry Industry Association and the head of a company engaged in forest certification.

Table 2.—Characteristics of the interviewed companies, including their products, ownership, and forest zone.

Company <sup>a</sup>	Products <sup>b</sup>	Ownership type	Forest zone
FI	Particleboard; MDF	State owned	Northeast
HF	MDF; particleboard	State owned	Southwest
DR	MDF/HDF; particleboard	Private	South
SW	MDF/HDF	Private	Southwest

<sup>a</sup> FI = Jilin Forest Industry Group Co. Ltd.; HF = HuaFun Forestry Group; DR = Dare Wood-Based Panel Group Co. Ltd.; SW = Guangxi Sunway Forest Products Industry Co. Ltd.

<sup>b</sup> Related to this study. MDF = medium-density fiberboard; HDF = high-density fiberboard.

The following measures were taken in order to ensure the validity and reliability of the findings. To ensure that the proposed questions reflected our research aim and that the terminology used in the questionnaire was understandable by the respondents, the questionnaires were pretested with two experts from the Chinese Forestry Industry Association. These experts were chosen because they are very familiar with the social responsibility fulfillment status of the case forestry enterprises and have often conducted on-the-spot investigations and have done some research on CSR in the forest sector. Based on the findings of the pretests, we added questions on the number of the specific terms of some strategy implementations. After the pretesting, the questionnaires were modified accordingly (for the questionnaire, see Appendix 2).

To ensure the continuity and consistency between the questionnaires and interviews, they were designed together beforehand. Furthermore, we analyzed CSR reports (2012 to 2015) and company Web sites released by the selected four companies and data released by industrial associations. These data sources (Table 3) were used to triangulate the data obtained from the questionnaires (Anderson 2010).

All the interviews were recorded, and notes were taken as a reference for data processing, contributing further to data validity (Anderson 2010). Anonymity was ensured to the respondents and interviewees during all phases of data collection, but the possibility of some social desirability bias cannot be completely excluded.

The analysis included the interview data as well as CSR reports of the case companies and other written data from the companies’ and CNFPIA Web sites. The data were analyzed with content analysis, which is performed by categorizing and codifying the documents based on the presence or absence of key words or concepts (Gummesson 1991). We first coded the data based on the strategy types outlined in the theoretical framework outlined earlier in this article. Using a data-driven approach, we then refined a category system (Flick 2009, Neuendorf 2016). The entire process was iterative, i.e., we analyzed the data manually, and when the category system was formed, we proceeded by going back and forth between the data and the theoretical background.

## Results

Table 4 shows examples of the reactive strategies of the four companies. Regarding land use, all of them have adopted sustainable management. In the interviews with HF informants, one of them explained that they had cooperated with universities and scientific research institutes to make

Table 3.—Summary of data sources and sample size.<sup>a</sup>

Companies and organizations	Respondents and sample size			Data type and sample size		
	Position	Questionnaires	Interviews	Corporate responsibility reports	Company Web sites	Data released by industrial associations
FI	Executives	2	1	5	1	5
	Mid-level managers	4	4			
	Employees	4	3			
HF	Executives	2	2	4	2	4
	Mid-level managers	4	5			
	Employees	4	2			
DR	Executives	2	1	2	1	2
	Mid-level managers	4	5			
	Employees	4	3			
SW	Executives	2	2	5	1	5
	Mid-level managers	4	4			
	Employees	4	2			
Forest certification company	Experts	—	1	—	—	—
Chinese Forestry Industry Association	Experts	—	2	—	1	2

<sup>a</sup> FI = Jilin Forest Industry Group Co. Ltd.; HF = HuaFun Forestry Group; DR = Dare Wood-Based Panel Group Co. Ltd.; SW = Guangxi Sunway Forest Products Industry Co. Ltd.

reasonable planning on the use of forestland. Note that FI manages the largest state-owned forest farm in China.

All four companies attached great importance to the protection of forest biodiversity and publicized its significance. In practice, the performance of FI and HF was greater compared with the other two companies. FI has dedicated 37,027 hectares of state-owned timberland to establish the “three lake” natural conservation area and 28,574.6 hectares of state-owned forest to establish the Redstone National Forest Park. In addition, FI has implemented the Natural Forest Protection Project. Similarly, HF has established eco-tourist attractions with specifically allocated forest areas for public outdoor activities and sightseeing. The informants explained that such strategies, dedicated to protecting forest biodiversity and enhancing eco-tourism, would bring long-term benefits to the company.

Regarding management practices, all of them adopted the mode of SFM, organized employees and clients for environmental protection training, and formulated sustainable environmental management rules and regulations. In

regard to SFM, HF explored an intensive management approach by cooperating with rural collectives or farmers as shareholders. For the structure of forest species, the four companies adhere to the principle of proper trees in proper places. While insisting on cultivating fast-growing and productive forests, they have cultivated multilevel mixed forests on a long-term, mid-term, and short-term basis. They have planted trees under the tree canopies and restored planted forests so as to improve stand quality and ecological stability, antiadversity, and disease and pest resistance in order to maintain the diversity of forests. To contribute to the progressive growth of vegetation restoration and forest reservation, plans have been made to renew planted forests, specifying postlogging aspects, such as the funding for replanting, planting time, planting methods, plantation tending and management, and buffer zone protection. In order to enhance forest quality and ecological functions, advanced technological achievements and best practices (tested by technological demonstrations in forest parks), such as developing fast-growing tree species, cultivating

Table 4.—Corporate social responsibility—environmental, social, and governance strategies of the interviewed companies: Examples of reactive strategies.

Reactive strategies	Company <sup>a</sup>			
	FI	HF	DR	SW
Modified land use	Sustainable management	Sustainable management	Sustainable management	Sustainable management
	Allocating forest areas to conservation areas	Allocating forest areas to eco-tourism		
	Natural Forest Protection Project			
Management practices	Sustainable forest management	Sustainable forest management	Sustainable forest management	Sustainable forest management
	Environmental protection training	Environmental protection training	Environmental protection training	Environmental protection training
	Sustainable environmental management rules and regulations	Sustainable environmental management rules and regulations	Sustainable environmental management rules and regulations	Sustainable environmental management rules and regulations

<sup>a</sup> FI = Jilin Forest Industry Group Co. Ltd.; HF = HuaFun Forestry Group; DR = Dare Wood-Based Panel Group Co. Ltd.; SW = Guangxi Sunway Forest Products Industry Co. Ltd.

large-diameter trees, and tending forests, have been promoted. FI has developed a series of systems, such as the Forest Administration Anti-Fire Software Development Technology System, Mobile Forest Fire Monitoring System, and Forest Tending and Managing Information System, to prevent forest fires and reduce chemical use.

Table 5 shows examples of the more responsive strategies and specific measures, including forest certification adoption and multiparty agreements. Forest certification is a tool used to promote SFM, such as the Forest Stewardship Council (FSC) certification and the Program for the Endorsement of Forest Certification Schemes. FSC certification includes forest management certification and chain of custody (COC) certification. Forest certification is also a way of committing to SFM. In order to be in line with international standards and gain sustainable development, more and more forestry companies in China have adopted FSC or FSC-COC certification (Zheng and Jiang 2002).

All of the selected companies work with FSC-COC certification. About 43,333 hectares of timberland managed by HF is certified by FSC. SW has gained FSC certification on 13,334 hectares of timberland through cooperation between forest farms and individual farmers. This form of cooperation is the first successful example in China. FI, which obtained the qualification for FSC certification in 2013, and DR are currently more focused on obtaining the FSC certification of their exclusive timberland, which is expected to be realized in 2017.

Finally, the examples of proactive strategies in Table 6 include three aspects: green traditional products (environmentally and socially responsible lumber), green technologies (energy cogeneration, waste treatments, and carbon-neutral commitments), and new products (biofuels, bio-products, and biochemicals).

First, all of the selected companies had implemented domestic green product standards. During the companies' timber procurement process, they all required the suppliers to operate under FSC-COC certification. In order to follow up on product quality and promote the concept of green products, FI opened an official Wechat account<sup>3</sup> to serve clients by providing green products. DR set up a special 400 hotline for after-sales service to verify the green products.

Second, the interviewed companies have developed new products to reduce formaldehyde emissions. FI improved and adopted flue gas drying equipment, HF used environmental adhesives and saving technology, and SW developed the technology of online gluing and abandoned the conventional measurements, such as glue materials, curing

agents, and formaldehyde scavengers. For saving water and reducing pollution, they all adopted comprehensive wastewater treatment systems, such as the advanced wastewater treatment transformation process of SW, which includes the following components: (1) microfilter to a primary sedimentation tank, (2) to an anaerobic tank, (3) to a cavitation air floatation system, then (4) to an aerobic tank, (5) to a sedimentation tank, and (6) to a clean water tank. DR developed waste gas treatment projects by introducing the wet electrostatic processing system from Germany in 2015. This is the first such example in this respect in the wood-based panel industry in China. In order to save and recycle resources, the enterprises made use of wooden wastes, such as wood chips and sanding wood powder, into heating centers. In addition, HF utilizes ashes as forestland fertilizer. These are examples of proactive actions being taken toward CSR.

All of the four interviewed companies have their own planted forests. According to the interviews, HF is affiliated with the state-owned Gaofeng Forest Farm, the largest forest farm in Guangxi Autonomous Region, the forest area of which covers two-thirds of the total area of Guangxi. DR is run by a separate forest company. According to CNFPIA (2015a), FI is the largest forestry industrial enterprise, based on its forest area, with 270,000 hectares used for forest resource management and logging. The company executives mentioned during the interview that SW has been cultivating forests with local collectives and farmers in Wuzhou, Guangxi, to achieve sustainable management.

When comparing the state-owned enterprises (SOEs) and the private enterprises (PEs), it appears that the SOEs have taken more practical and sustainable strategies on land use for the protection of biodiversity and the environmental public interest. This relates to their ownership type since they are required to undertake more environmental responsibilities. PEs have more advanced equipment introduced from developed countries and have developed new technologies in the process of production.

## Discussion and Conclusions

CSR has increasingly become a crucial issue for maintaining the competitive advantage of forestry enterprises (Toppinen et al. 2016). By adopting new strategies and practices for environmental and social issues for sustainability, the leading enterprises in the Chinese wood-based panel processing industry are on their way to improving CSR and promoting the sound development of the whole industry.

The selected cases in this research are wood-based panel enterprises sourcing from industrially grown forests. Our results suggest that the four wood-based panel enterprises analyzed in this study have invested considerable manpower

<sup>3</sup> Social networks such as Wechat are currently very popular in China; they support company marketing strategies and serve as customer service platforms.

Table 5.—Corporate social responsibility—environmental, social, and governance strategies of the interviewed companies: Examples of responsive strategies.

Responsive strategies	Company <sup>a</sup>			
	FI	HF	DR	SW
Forest certification adoption	FSC-COC certification	FSC certification FSC-COC certification	FSC-COC certification	FSC certification FSC-COC certification

<sup>a</sup> FI = Jilin Forest Industry Group Co. Ltd.; HF = HuaFun Forestry Group; DR = Dare Wood-Based Panel Group Co. Ltd.; SW = Guangxi Sunway Forest Products Industry Co. Ltd.; FSC = Forest Stewardship Council; COC = chain of custody.

Table 6.—Corporate social responsibility—environmental, social, and governance strategies of the interviewed companies: Proactive strategies.

Proactive strategies	Company <sup>a</sup>			
	FI	HF	DR	SW
Green traditional products (environmentally and socially responsible lumber etc.)	Green product standards FSC-COC (suppliers) Official Wechat account	Green product standards FSC-COC (suppliers)	Green product standards FSC-COC (suppliers) 400 hotline	Green product standards FSC-COC (suppliers)
Green technologies (energy cogeneration, waste treatments and carbon-neutral commitments)	Flue gas drying equipment New products to reduce formaldehyde emissions Wastewater treatment systems Wood residues recycled as fuels at heating centers	New products to reduce formaldehyde emissions Environmental adhesives and saving technology Wastewater treatment systems Wood residues recycled as fuels at heating centers Ash as forestland fertilizer to use	Waste gas treatment projects by introducing the wet electrostatic processing system New products to reduce formaldehyde emissions Wastewater treatment systems Wood residues recycled as fuels at heating centers	Technology of online gluing and canceling separate continuous measurements New products to reduce formaldehyde emissions Wastewater treatment systems Wood residues recycled as fuels at heating centers

<sup>a</sup> FI = Jilin Forest Industry Group Co. Ltd.; HF = HuaFun Forestry Group; DR = Dare Wood-Based Panel Group Co. Ltd.; SW = Guangxi Sunway Forest Products Industry Co. Ltd.; FSC = Forest Stewardship Council; COC = chain of custody.

and material resources in cleaner production. However, their commitment to the treatment of waste gases (volatile organic compounds [VOCs]) is relatively low compared with other measures. Based on this, there is further need to pay particular attention to the treatment of waste gases (VOCs), especially considering the severe harmful effects on human health and the environment of beyond-standard VOCs, such as formaldehyde. A way to address this issue is by introducing more advanced equipment and technology. Furthermore, our case enterprises in the forestry wood-based panel business have made relatively large investments in SFM, forest certification, and industrial certification, yet relatively few investments have emerged in material recycling and biodiversity protection and eco-tourism development in forest zones. In particular, all of the selected companies work with FSC-COC certification, which can be considered to signal proactiveness in this industry segment because this practice is only now emerging in China (Kenneth et al. 2015).

Regarding the overall ambition of CSR/ESG strategies in the wood-based panel enterprises in China, the companies identified in our study have different orientations, including reactive, responsive, and proactive strategies. A similar result was also found in Wan et al. (2015), indicating that China's wood products industry is entering a period of strategic reforms, with industry leaders pursuing upgrading from the traditional low-cost manufacturing strategy toward a differentiation strategy and enhanced environmental responsibility. While the selected enterprises have adopted comprehensive strategies to improve their corporate social and environmental performance, even in the proactive stage, genuinely new green products have not yet been introduced to the markets. Therefore, moving forward in terms of product stewardship represents an important development direction in the future for sustainability-oriented producers in emerging countries such as China. Finally, the more detailed analysis of the specific driving factors for corporate social and environmental responsibility remains a topic of high interest for further research (e.g., see Tuppuru et al. 2013). A challenge also remains for forest industry companies in defining the materiality of sustainability-

related issues and effectively understanding and balancing the various needs and expectations arising from different interest and stakeholder groups.

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*Appendix 1.—Sources other than interview and questionnaire data analyzed in the study.<sup>a</sup>*

Material	Source
Corporate social responsibility reports	
FI (2011, 2012, 2013, 2014, 2015)	<a href="http://jlsg.com.cn">http://jlsg.com.cn</a>
HF (2012, 2013, 2014, 2015)	<a href="http://huafenglinye.bygone.smenn.com.cn">http://huafenglinye.bygone.smenn.com.cn</a>
DR (2014, 2015)	<a href="http://www.darepanel.com">http://www.darepanel.com</a>
SW (2011, 2012, 2013, 2014, 2015)	<a href="http://www.3sunway.com">http://www.3sunway.com</a>
Company Web sites	
FI	<a href="http://jlsg.com.cn">http://jlsg.com.cn</a>
HF	<a href="http://huafenglinye.bygone.smenn.com.cn">http://huafenglinye.bygone.smenn.com.cn</a>
	<a href="http://www.gaofenglinye.com.cn/hfjt/list_34.aspx">http://www.gaofenglinye.com.cn/hfjt/list_34.aspx</a>
DR	<a href="http://www.darepanel.com">http://www.darepanel.com</a>
SW	<a href="http://www.3sunway.com">http://www.3sunway.com</a>
CNFPIA	<a href="http://www.cnfpia.org/index.html">http://www.cnfpia.org/index.html</a>
Data by industry associations	
White paper of corporate social responsibility in forestry enterprises of China (CNFPIA 2015a)	<a href="http://www.cnfpia.org/index.html">http://www.cnfpia.org/index.html</a>
Wood-based panel product quality survey report of China in 2015 (CNFPIA 2015b)	<a href="http://www.cnfpia.org/index.html">http://www.cnfpia.org/index.html</a>

<sup>a</sup> FI = Jilin Forest Industry Group Co. Ltd.; HF = HuaFun Forestry Group; DR = Dare Wood-Based Panel Group Co. Ltd.; SW = Guangxi Sunway Forest Products Industry Co. Ltd.; CNFPIA = China National Forestry Products Industry Association.

*Appendix 2.—Main questions asked in the interviews.*

Aspects	Questions
Reactive strategies	What are the main corporate social responsibility (CSR) strategies and practices your company has taken on land use? (i.e., Are there any forest areas for eco-tourism? And the quantity?) What are the main CSR management practices your company has taken? Is there any other aspect you think needs to be improved?
Responsive strategies	Is there forest certification adoption by your company? (i.e., Forest Stewardship Council? Others? And the quantity of the forest certification adoption for forest areas?) Is there any other aspect you think needs to be improved?
Proactive strategies	What are the main CSR strategies on green traditional products in your company? (i.e., environmentally and socially responsible lumber, etc.) What are the main CSR strategies on green technologies in your company? (i.e., energy cogeneration, waste treatment and carbon-neutral commitments, etc.) Are there new green products introduced to the markets of your company? (i.e., biofuels, bioproducts, biochemicals, etc.) Is there any other aspect you think needs to be improved?