

Article

# The Impact of Integrated Practices of Lean, Green, and Social Management Systems on Firm Sustainability Performance—Evidence from Chinese Fashion Auto-Parts Suppliers

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**Abstract:** To better satisfy various stakeholders, firms are seeking integrated practices that can enhance their sustainability performance, also well known as the Triple Bottom Line (3BL). The fashion industry exhibits potential conflicts with the spirit of sustainability because of the waste created by high levels of demand uncertainty and the extant usage of resources in production. Literature suggests that selected stand-alone practices of lean, green, and Corporate Social Responsibility (CSR) management systems have a positive impact on firm sustainability performance. However, how the combination of selected practices from these three management systems impacts the 3BL remains unclear. Based on case studies, we build an integrated sustainable practices model incorporating the most popular lean, green, and social practices and develop propositions for future tests. Our

framework suggests the implementation of integrated practices would have a stronger influence on 3BL performance than individual practice implementation.

**Keywords:** lean; green; social; sustainability; Triple Bottom Line (3BL)

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## 1. Introduction

Sustainability, or sustainable development, is broadly defined as “development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs” [1]. In a business context, Savitz and Weber [2] suggest that “a sustainable company is one that creates profit for its shareholders while protecting the environment and improving the lives of those with whom it interacts”. Sustainability has three dimensions, namely, economic prospects, ecological balance, and social responsibility [3]. It is the balanced development and harmonious interaction of these three dimensions that ensures the continuous development of the business and the society.

In terms of sustainability, fashion seems a contradictory concept considering its resource utilization and environmental impacts. According to Christopher *et al.* [4], fashion is a broad term which “encompasses any product or market where there is an element of style which is likely to be short-lived”. The fashion market exhibits four important characteristics, namely, short life-cycles, high volatility, low predictability, and high impulse purchasing [4]. As a result, fashion products require extant resources. However, with unstable and unpredictable demand, the resources invested are prone to become waste, contradicting the spirit of sustainability [4,5]. Besides, the fashion industry has also been criticized for its negative impacts on the natural environment, such as the emission of high levels of pollutants and consumption of environmentally unfriendly energy [5].

The clothing and beauty industries have been well studied fashion industries in past research [6]. Yet, despite the fact that the automobile is an important symbol for people to show their fashion taste, the automotive industry has rarely been used as an example of a fashion-related industry [7]. The relationship between fashion and automobiles, however, dates back several decades during which many changes have occurred in the evolution of the automobile. Literature suggests that the automobile has not turned into a full fashion product like clothing simply because it is costly to supply frequent styling changes [7]. Fashion and automobiles are united and influenced by intended function, environment, and lifestyle, and the possibility of co-creation occurs when automotive R&D centers are located closer to “fashion centers” [8]. Fashion in the automobile industry can be visualized externally through unique styles and models and internally through posh interior decorations and accessories. The increasing fashion trend in the automotive industry stems from the increase in personal customization during the automobile design and production stages [9]. For instance, the success of the fashionable Mini Cooper is partly a result of the internal and external customization as per end user preferences [10]. Fashion auto-parts suppliers such as rubber and plastic interior components manufacturers play a crucial role in the development of cars with unique interiors and exteriors. This study focuses on automotive firms specializing in parts and components that contribute to fashion trends, including plastic parts for interior and exterior trim systems, seating systems, and others.

The fast obsolescence of fashion products due to styling and frequent new model introduction has increasingly exposed such products to sustainability concerns such as environmental and resource problems [6]. As a majority of parts for interior design come from suppliers [11], we believe that suppliers have a decisive influence on the fashion degree of the car. As a result, we focus our study on the fashion auto-parts suppliers' sustainable practices. In the current highly competitive business environment, manufacturers worldwide are facing pressure from various stakeholders to embrace sustainability management systems. As Zhu *et al.* [12] indicated, stakeholders such as government agencies, consumers, and competitors all have different expectations of companies that cannot be fully met by improving firms' focus on the single bottom line alone. As a result, to survive and achieve sustainability, firms need to find ways to concurrently raise their performance in economic, environmental, and social dimensions. These three performance indicators, economic, environmental, and social, are collectively referred to as the Triple Bottom Line (3BL) [13]. The 3BL is considered one of the best ways to measure a firm's sustainability performance [3].

Popular management systems which can enhance firms' 3BL performance include lean, green, and social systems [14,15]. The lean production system has been widely accepted in the general manufacturing field, and firms have witnessed considerable financial benefits through implementing lean management systems [16–18]. Green and social management systems have also been proven to have positive impacts on firm performance in various aspects [18]. Until now, however, these management systems have only been studied in isolation, with existing studies focusing on either environmental issues [15] or CSR-related problems [19,20]. To appreciate sustainability in a more comprehensive sense, these three streams of literature need to be simultaneously considered. Furthermore, the influence of individual practice on 3BL performance is not fairly distributed and mandates a set of practices to meet the expected requirements in the three dimensions of performance.

Therefore, to bridge this research gap and develop a comprehensive framework of sustainability, important lean, green, and social practices selected from each management system are integrated in this study. The resultant integration of these practices is referred to as LGS (lean, green, and social) practices. To our best knowledge, this is the first attempt to integrate LGS practices from different management systems and to study their impact on 3BL performance. In previous studies, the selected practices have so far only been independently dealt with or combined as a pair such as LG rather than as a triad. The combination of selected practices from each management system suggested in this paper will enable firms to achieve 3BL performance.

The main purpose of this study is to empirically investigate the impact of integrated practices picked from lean, green, and social management systems on the 3BL performance of fashion auto-parts suppliers. This study contributes to both theoretical and practical literature. In the first instance, to the best of our knowledge, this is the first study to integrate popular practices of lean, green, and social management systems to establish a triadic practices framework. It contributes to the comprehensiveness of sustainability literature by covering a broader range of practices. Secondly, this study enriches and extends the fields of fashion and sustainability literature, especially in the context of the automotive industry and China. As the world's largest manufacturing base, China in particular has both domestic and international coercive, normative, and mimetic pressures to achieve its diverse objectives of sustainability [21].

Past studies on sustainability have tended to focus on industrialized Western nations [22,23], with limited attention paid to emerging economies such as China [24]. Finally, the findings of this study will, hopefully, provide insights on how sustainability can be achieved based on a comprehensive consideration of lean, green, and social best practices for both policy makers and practitioners.

## 2. Literature Review

### 2.1. Lean Management System and Benefits

Lean Production, also called the Toyota Production System (TPS), is defined as “an integrated manufacturing system that is intended to maximize the capacity utilization and minimize the buffer inventories of a given operation through minimizing system variability (related to arrival rates, processing times, and process conformance to specifications)” [25]. Lean production rests on bundles of practices aimed at reducing and eliminating all forms of waste from firms’ manufacturing operations [14]. These bundles of practices are interrelated, internally consistent, and mutually facilitating, mainly including Just-In-Time (JIT), Total Quality Management (TQM), Total Preventive Maintenance (TPM), Human Resource Management (HRM), pull, controlled processes and flow, *etc.* [14,16,17]. Lean production increases profitability by systematically minimizing waste and increasing efficiency [26]. It is a management system covering “everything in an organization starting from product development to its distribution to end customers” [27].

Lean production is directly related to a firm’s profitability and indirectly addresses concerns related to environmental and social dimensions [18]. However, researchers expect lean implementation should go beyond the boundaries of individual firms and cover a wide range of stakeholders along the supply chain, such as suppliers, shareholders, employees, customers, as well as the society as a whole [27].

Lean production practices have been well studied in the past decades. Researchers have linked the implementation of various lean practices with different dimensions of firm performance. Lewis [28], Yang *et al.* [14], and Hofer *et al.* [26], among others, found a positive impact of lean implementation on firm financial performance through the mechanisms of enhanced productivity and inventory leanness. Others, on the other hand, confirmed a positive influence of lean practices on firm environmental performance [14,17,29]. The relationship between lean implementation and social practices has also been emerging in academic research in recent years [18]. However, we found the results are not systematic. According to De Treville and Antonakis [25], the most important mechanism through which the implementation of lean practices impacts social performance is the internal human resources of the firms. By empowering, educating, motivating, and job designing for employees, lean practices positively influence workers’ attitudes and productivity, which enhances firms’ social reputation.

### 2.2. Environmental Management System and Benefits

Companies are becoming increasingly concerned about the environment. This concern is best illustrated in their adoption of environmental management systems. Previous research suggests two forms of environmental management: internal (green production) and external (green supply chain management) [12,30]. While green production aims to achieve greenness and sustainability at the manufacturing stage, green supply chain management pursues the same goal by making strategic

decisions by cooperating with external partners [30]. These two aspects of environmental management, though having different focuses, aim to reduce the negative environmental impacts of firms' activities.

Commonly used green production practices discussed in the existing literature include environmental design, raw material reduction (both in terms of quantity and variety), as well as green manufacturing [31]. By engaging in such activities, firms can reduce the negative impact of their products and production process on the natural environment, which may create a long-term financial benefit for them [14].

A popular topic in sustainability research, the relationship between environmental management practices and various aspects of firm performance is well researched [30,32,33]. The positive impact of environmental management practices on financial performance was found by some to be mediated by enhanced environmental performance [14,15], while others found this relationship to be bidirectional, as financially stronger firms tend to experience a more positive effect from environmental management adoption [30,34]. Zeng *et al.* [35] also confirmed the positive effects of environmental management practices on financial performance in an emerging economy context. The implementation of environmental management practices impacts environmental and social performance through reducing resource consumption and improving stakeholder relations [17,33].

### 2.3. CSR Management System and Benefits

The social dimension is commonly recognized as “the weakest pillar of sustainability” [36]. A commonly accepted definition is lacking, however, because there is no consensus on what the social aspect is exactly about. One of the most widely accepted concepts in the social area is Corporate Social Responsibility (CSR). CSR is defined as “a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis” [37].

CSR is believed to have the potential to make organizational practices more transparent and socially responsible [38]. It is the continuing commitment by the business to behave ethically and enhance economic development while improving the quality of life of the workforce and their families as well as the local community and the society at large [39]. As the definition indicates, CSR is closely related to the fulfillment of stakeholder needs from both the internal and external sides of the organization [40]. However, it is worth noting that socially responsible practices should be consistent with business objectives (*i.e.*, profit making) [41].

Clarkson [42] and Shafiq *et al.* [43] indicated that CSR can be better assessed from a stakeholder perspective. All the stakeholders, shareholders, employees, customers, business partners, the community, and the natural environment are closely related to the firm's social actions [44]. Based on the stakeholder framework of CSR, this study assesses corporate social practices from the perspectives of employees, customers, business partners, and the community. Specific practices such as the improvement of employee working and living conditions, employee care, fair compensation, customer satisfaction, fair trade with suppliers, and philanthropic activities are among the most frequently assessed in previous studies [33,43,45]. By engaging in these practices, companies can enhance their corporate reputation, which in turn contributes to an improved financial performance in terms of an increase in

sales [45,46]. On the other hand, a social management system focusing on employees, by motivating and educating them, could also improve financial performance through enhanced productivity [47].

Empirical studies on the relationship between CSR implementation and firm financial performance are inconclusive. Similarly, it is not well known how the implementation of social practices impacts the environmental and social dimensions. For example, a positive relationship between CSR and financial performance was found by Waddock and Graves [19], Lin *et al.* [41], Ruf *et al.* [48], and Wagner [49]. While other researchers such as Mahoney and Robers [20] and Parast and Adams [50] found no significant relations between the two, Saeidi *et al.* [51], Benavides-Velasco *et al.* [52], and Pätäri *et al.* [53] identified that the relationship between CSR and firm financial performance is mediated by factors such as enhanced reputation and brand image, customer satisfaction, resource and capacities improvement, enhanced managerial competence, talent acquisition, and goodwill creation.

#### *2.4. Synergistic Effects among Lean, Green, and CSR Management Systems*

The synergistic relationship between lean and green has been well studied [29,54]. King and Lenox [29] found that firms' adoption of quality management standard ISO 9001 is positively related to the adoption of environmental management standard ISO 14001. By implementing lean practices, firms reduce resource use waste and emissions, an objective shared by green practices [29,54]. In general, we can conclude that there is a mutual facilitation between lean and green practices implementation.

With respect to the relationship between lean and social practices, there has been no systematic analysis so far. Most studies regard firms' human resources as the connecting point between lean and social practices [18]. Empowering and educating the employees facilitates their self-development. Besides, TPM activities largely prevent workplace injuries and deaths, contributing to better employee health and safety [55]. As we adopt a stakeholder perspective for social practices [43], customers, suppliers, and the community also need to be taken into account as important stakeholder groups. Lean practices impact customers mainly through TQM programs, as customers are paying increasing attention to product quality these days. The synergistic effects among practices of lean, green, and social management systems are important in firms' decision-making on integrating these practices.

### **3. Research Gap and Scope of This Study**

Lean, green, and social management systems as important sustainable practices have been extensively studied by academic researchers. However, so far they have only been dealt with separately. From a sustainability perspective, existing studies fail to comprehensively understand the impact of the integration of selected practices from lean, green, and social management systems on 3BL performance. As a three-dimensional issue, sustainability should be studied in a more comprehensive manner. To bridge this gap, we select popular practices from lean, green, and social management systems to examine the impact of the integrated sustainable practices on firm 3BL performance, attempting to build a comprehensive sustainability framework and propositions for future tests.

#### 4. Research Methodology

The current study employs a case-study methodology to develop a triadic framework relating integrated practices to 3BL performance. A case study is a useful research method when existing literature seems inadequate due to little empirical substantiation [56]. The case-study method is mainly designed to answer “how” and “why” questions [57]. It is considered as appropriate in the early stages of a research area or to provide fresh insights to an already researched topic [57]. Below we provide details of the methodology approach and justification of firm selection in this study.

##### 4.1. Chinese Automotive Sector

China is the world’s largest automobile producer and consumer. The automotive sector is also a pillar industry of China’s economy. The annual output value of auto products in China was 2953 billion RMB in 2009, accounting for approximately 8.7% of the national GDP [58]. Besides, the development of the automotive sector has stimulated the emergence and expansion of over 90 other sectors, such as steel, oil, and service [58]. The Chinese automotive industry is expected to experience the largest growth of all industries in the following decades [59]. Similarly, the rise in middle class income increases the buying power for not only the conventional vehicle but also the trendy fashion vehicles. The sustainable development of the automotive sector will therefore play a significant role in ensuring the healthy development and safety of the national economy. However, in recent years, increasingly serious pollution and employee- and community-related issues are challenging the sustainable development of the Chinese automotive sector. As a result, we choose the Chinese automotive sector as our research setting.

In mainland China, there are six major automotive clusters, namely, Northeast, Bohai Sea, Yangtze River Delta, South Central, Pearl River Delta, and Southwest [60]. The province of Zhejiang, located in the Yangtze River Delta, has one of the largest number and varieties of automotive companies, including assemblers, fashion auto-parts suppliers, and other parts suppliers, contributing heavily to the regional and national throughput. Therefore, we believe that examining Zhejiang-based companies specifically facilitates our understanding of the Chinese auto fashion industry as a whole.

##### 4.2. Sample and Case Companies’ Profiles

We identified three categories of companies from the Directory of Auto-parts Companies in China, namely, big and famous enterprises with more than 500 employees, medium-sized companies with 200–500 employees, and small companies with no more than 200. We believe that a better understanding of the industry can be obtained from studying a representative from each category. As a result, we randomly selected some companies from each category and sent out research invitations. We finally got access to the following three case companies. Semi-structured interviews with upper-level managers as well as multiple observations of their company operations were carried out at the selected case companies.

For confidentiality reasons, the case companies will be referred to as *Company A*, *Company B*, and *Company C*. A summary of the selected case companies’ profiles follows.

*Company A* is a leading vehicle plastic components provider and exporter in Zhejiang Province, China. Its main products include plastic parts for automotive interior and exterior trim systems, plastic

parts for power systems, and plastic parts for seating systems. Located in Yuyao City, it has a history of 23 years and 1256 employees. Company A emphasizes a continuous improvement of R&D ability. The respondent is the CEO of the company.

*Company B* also operates in Yuyao City, Zhejiang Province. It mainly provides rubber components for vehicles. Company B has been in operation for 17 years and currently has 170 employees. The respondent is the assistant general manager and has a good knowledge about the firm's operations.

*Company C* is located in Wenzhou, Southern Zhejiang. It is a leading producer and exporter of auto electric interior assemblies. Company C has a product R&D team composed of well-known professors and senior engineers. Founded in 1995, it is now a rapidly growing company with 320 employees. The current position of the respondent from this company is the sales manager; however, he had worked in the operations department for more than a decade before joining sales.

#### 4.3. Data Collection

We began our semi-structured interviews with standard questions adapted from established measures as shown in Appendix. Questions on lean implementation were from the framework developed by Shah and Ward [16], which includes Just-in-Time (JIT), Total Quality Management (TQM), Total Productive Maintenance (TPM), and Human Resource Management (HRM). Green practices questions were adapted from Hajmohammad *et al.* [17] and Gonzalez *et al.* [31]. Items were grouped into raw material selection and reduction, emissions and discharges control, and recycling and waste management. Questions on social practices were based on a stakeholder perspective [43]. All the stakeholders, shareholders, employees, customers, business partners, the community, and the natural environment are closely related to the firm's social actions [44]. This study evaluates corporate social practices from the perspectives of employees, customers, business partners, and the community. Respondents were asked to describe the implementation level of selected lean, green, and social practices in their own company.

Information on 3BL performance was obtained from both primary and secondary sources. For financial performance, accounting measurement items of Return on Assets (ROA) and Return on Sales (ROS) were selected based on previous literature [14,44]. Respondents calculated ROA and ROS using internally audited financial reports. Cost reductions and sales increases achieved from implementing sustainable practices were also used. For environmental performance measures, which includes air emissions, wastewater generation, solid waste disposal, consumption of hazardous/harmful/toxic materials, and energy consumption, were adapted from Hajmohammad *et al.* [17]. For firm social performance, the enhancement of social reputation is believed to be appropriate [3]. However, to deal with the subjectivity of this measure, the number of social awards was selected as another proxy for social performance. Respondents' perceptions of 3BL performance together with website information and other reported evidence provided by them were included.

The standard questions were followed by open questions for more in-depth understandings of the case companies' implementation of sustainable practices and their 3BL performance.



#### 4.4. Credibility Enhancement and Bias Avoidance

Triangulation is used in this study to enhance credibility of the data and avoid qualitative research bias [61]. According to Patton [61], methods triangulation refers to “checking out the consistency of findings generated by different data collection methods”, while triangulation of sources is the utilization of multiple data sources in the same data collection method. We mainly used triangulation of sources in this study. Firstly, we carried out semi-structured interviews consisting of both standard and open questions to understand the implementation issues and 3BL performances. After the standard questions, we did multiple rounds to follow up and to sort out ambiguities between practices and performances. Secondary data such as website information was also used to supplement the primary data. Consistencies exhibited in different data sources and possible explanations for differences can contribute to the credibility of the result of the study.

#### 4.5. Observations

We began our investigation by asking the respondents if their companies are currently implementing lean, green, and social practices. According to the senior-level managers, all three case companies are, to a certain degree and at varying levels, engaged in these sustainable practices. We created a code of “low”, “medium”, and “high” to interpret their extent of implementation of each practice and current 3BL performance. If the companies are implementing more than half of the selected practices within each category, they are coded as “high”. It is “medium” if a company is implementing half of the practices in this category. If less than half of the practices are implemented, we label the implementation level as “low”. Take JIT for instance. There are ten practices in the JIT category (see Appendix for details). If the respondent from Company A expresses that the company is implementing five practices, we label Company A’s implementation level of JIT as medium. Accordingly, if Company B is implementing three practices and Company C eight, their implementation levels of JIT are “low” and “high”, respectively. According to Shah and Ward 2003, the ten practices in the JIT category are closely related to each other, and they share a common goal of reducing and ultimately eliminating all forms of waste. Instead of viewing them as individual practices, it is more appropriate to see them as a JIT system. As a result, we believe a company is not a real JIT company if it lacks more than half of the system. This is also the case for green and social practices. We then take the average value of JIT, TPM, TQM, and HRM to form the implementation level of lean management systems of each company. The same procedure is applied to green and social practices implementation. The coding of 3BL performance data was based on Yang *et al.* [14]. If the performance of a company improves 10%–30% compared with last year, we code it as “medium”. Improvement of less than 10% is labeled as “low” and more than 30% is “high”. Similarly, the average value of all the subsets of each performance is taken as the performance level. The results are summarized in Table 1.

**Table 1.** Summary of results.

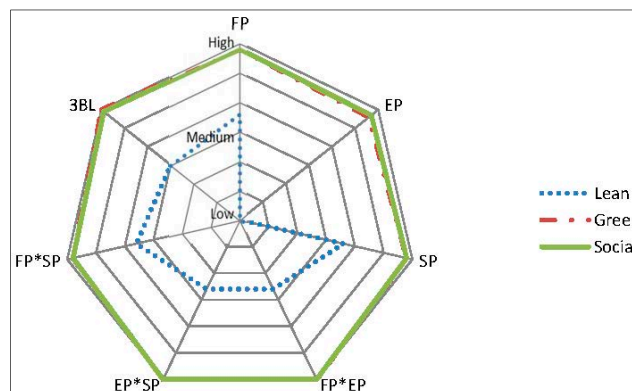
Company	Respondents’ Position	Lean	Green	Social	FP	EP	SP
A	CEO	high	high	high	high	medium	high
B	Assistant general manager	medium	medium	low	low	low	low
C	Sales manager	high	medium	medium	medium	medium	medium

(Note: FP: Financial Performance; EP: Environmental Performance; SP: Social Performance).

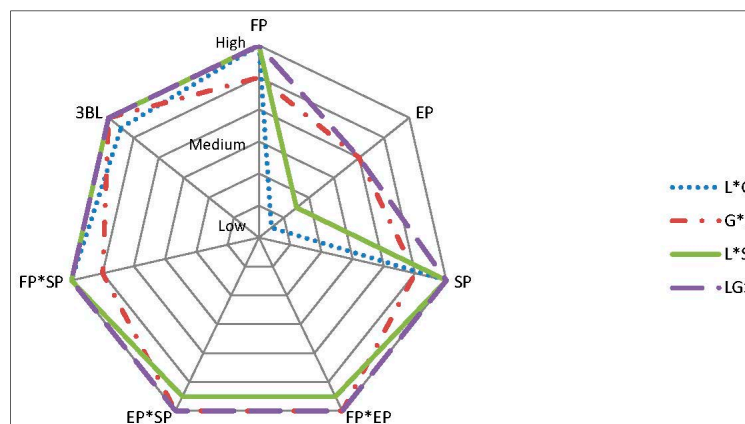
According to the interview results, Company A is the most sustainable of the case companies, with a high implementation of selected lean, green, and social practices. The 3BL performance of Company A is relatively high compared with Companies B and C. The second most sustainable company is Company C, with medium and high levels of LGS implementation and medium 3BL performance. Company B, the least sustainable of the three case companies, has medium and low implementations of sustainable practices and subsequently low 3BL performance.

### 5. Discussions and Propositions Development

Correlation analysis was conducted to investigate the strength and direction of the relationship between each sustainable practice (lean, green, and social) and 3BL performance for the three case companies. The results are summarized in Figures 1 and 2. We believe that the spider charts better visualize the correlation between individual and combined lean, green, and social practices and 3BL performance. We analyzed open questions data following Ryan and Bernard’s [62] technique. We identified themes and reorganized the information according to themes. The themes include the relationships between sustainable practices and 3BL performance, both individually and collectively. The results are applied where appropriate to support the structured questions results.



**Figure 1.** Correlation between individual practice and performance. Note: \* indicates the composite effect.



**Figure 2.** Correlation between possible combinations of LGS practices and performance. Note: \* indicates the composite effect.

Figure 1 illustrates the correlation between lean, green, and social practices and different combinations of financial, environmental, and social performance. This is to show the effect of independent implementation of these sustainable practices on firm performance. Figure 2 presents the correlation between combinations of lean, green, and social practices and firm performance, which shows the way integrated practices impact firm performance.

### 5.1. The Integrated LGS Practices and 3BL Performance

Correlation results show clearly that a combination of lean, green, and social practices contributes significantly to 3BL performance, individually or collectively. As Figure 2 indicates, the line for LGS practices-3BL performance correlation reaches further ends than any other combination of practices, which means that the relationship between a combination of LGS practices and 3BL performance is the strongest. LGS practices together can provide firms with the sustainable development they are pursuing [63]. The result provides strong evidence that companies can improve their 3BL performance through an integrated implementation of lean, green, and social practices. However, we cannot support this result based on established studies because, to our best knowledge, there has been no research so far which takes these three sustainable practices collectively into account.

This result also finds support in data collected from open questions. Respondents from all case companies expressed clearly the benefits brought by LGS practices since implementation. Besides, according to the respondents, it is impossible to ignore any of the practices due to stakeholder requirements in the current business environment. However, they have all experienced the benefits brought about by LGS practices such as financial gains (emphasized by all case companies), regulation compliance and the avoidance of penalty (emphasized especially by Company A whose major products are plastic auto parts), talent and higher employee retention (emphasized by Company B), and better position in the marketplace (emphasized by Company C) and enhanced reputation (emphasized by all case companies).

Based on both observations and qualitative data, we propose that:

Proposition 1: The implementation of LGS practices is positively and significantly related to firm 3BL performance.

### 5.2. Lean Practices and 3BL Performance

As Figure 1 indicates, the relationship between lean practices and 3BL performance is less significant when compared to both green and social practices. The result is consistent with previous findings [14,64]. Yang *et al.* [14] found empirically that lean manufacturing practices benefit firm financial performance by systematically eliminating waste and variance, while Cusumano [64] suggested that JIT (an important part of lean) increases the environmental burden by making transportation activities more frequent. According to Figure 1, the line for the correlation between lean practices alone and environmental performance reaches the nearest end. Though it indicates a positive relationship between the two, the strength of the relationship is the weakest among all.

As an important component of sustainability, firm social performance has rarely been associated with lean practices so far. However, results show that there is actually a positive relationship between

lean and social performance. This might be, to a large extent, achieved from the HRM part of the lean construct [18]. By empowering, educating, and caring for employees, the reputation of a company can be improved, which will bring the company social awards in the long term.

The relationship between lean and 3BL performance as a whole is positive and significant, according to Figure 1. As a popular practice for waste reduction and efficiency improvement, together with its role in empowering and enlightening firms' human resources, lean simultaneously enhances firm 3BL performance. In short, lean can be considered as a sustainable practice.

Regarding the implementation and benefits of lean practices, respondents from all case companies provided empirical support during open questions. All three companies suggested lean practices are adopted to improve efficiency rather than to achieve environmental benefits. Specifically, Company A stated that the positive influence of lean practices on environmental performance is a long-term goal. As the respondent stated, one can expect but cannot rely completely on lean practices to deal with environmental challenges such as compliance with environmental regulations. Another interesting point we identify from direct observation and interviews is the impact of lean projects on employees' sense of responsibility. A kind of kanban is common in all three case companies which specifies the date and duration of a certain work and name of the person in charge. This makes it easier to track down the exact person when problems are found. The use of kanban as a tool largely reduces defects and variants, which in turn enhances financial performance. From a social perspective, lean practices improve employees' capabilities, which facilitate self-development. According to the respondent from Company C, the stimuli system in his company has motivated numerous employees to be more innovative and contributing, helping them in self-value realization and confidence building. Based on the above, we propose that:

P2: The implementation of lean practices is positively related to firm financial, environmental, social, and 3BL performance.

P3: Implementing lean practices only has less positive impact on 3BL performance compared with implementing integrated LGS practices.

### 5.3. Green Practices and Performance

Consistent with Hajmohammad *et al.* [17], who found a significantly positive relationship between the implementation of environmental practices and environmental performance, our findings suggest a high correlation between green practices and environmental performance. Based on the specific questions used in the semi-structured interviews regarding green practices, it is clear that measures taken to reduce raw material consumption, to control emission and discharge, and to increase recycling and waste management can at least to some extent result in decreased raw material consumption, emission, waste water generation, and energy use. However, according to Figure 1, it is noteworthy that the correlation, though high enough to indicate a strongly positive relationship between green practices and environmental performance, is slightly lower than that of financial performance, social performance, as well as different combinations of performance. A possible explanation would be that both directly and indirectly, green practices contribute to the improvement of financial performance and social performance. On the one hand, the reduction in raw material consumption directly results in cost savings (financial performance); environmental efforts, if properly conveyed to the public,

immediately enhance the social reputation and the number of social awards of the firm (social performance). On the other hand, the improved social performance stimulates customers' positive perception of the company's image [65], which will then translate into a sales increase.

Figure 1 indicates that there is a strong positive relationship between green practices and 3BL performance as a whole. This finding is consistent with most of the previous research which regarded sustainability as simply being environmental-related issues [66]. According to the respondents from all case companies, there are two main drivers that influence their companies to implement green practices, the potential financial benefits and environmental regulations. So far, the financial benefits realized include reduced cost (emphasized by all respondents), more stable contracts with business partners, and a reduced amount of penalties achieved from improved environmental performance. Company A also highlighted the reduced number of complaints from local people since its implementation of sewage filters. Green practices thus benefit every dimension of 3BL performance. However, the positive effects can be strengthened by combining green with lean and social practices.

As a result, we propose that:

P4: The implementation of green practices is positively related to firm financial, environmental, social, and 3BL performance.

P5: Implementing green practices only has less positive impact on 3BL compared with implementing integrated LGS practices.

#### 5.4. Social Practices and Performance

According to Figure 1, social practices have a significant positive relationship with firm 3BL performance collectively and individually. By providing various forms of support for stakeholders of employees, customers, business partners, and the community, the firm's social reputation and number of social awards improve significantly. Financial performance of the firm also increases. The result is consistent with Lee *et al.* [46], who found that employee rights and safety protection are positively related to firm financial performance through the mechanism of corporate reputation. From a more comprehensive perspective, the result of this study supports Saeidi *et al.* [51] and Lin *et al.* [41], who found a positive relationship between CSR activities and financial performance.

Traditionally, researchers tend to include environmental issues in CSR [44]. In this study, we separate these concepts to better understand their unique effects on different dimensions of sustainability. Surprisingly, our findings suggest a significant positive relationship between social practices and environmental performance after we exclude the environmental issues. However, a possible explanation would be that it is impossible to definitely separate the environmental and social dimensions of sustainability. Eco-friendly activities surely benefit the society and stakeholders.

The correlation between social practices and 3BL performance is high, which indicates that firms can largely achieve sustainability from the implementation of social practices. Despite the prior investment involved in social practices implementation, Chinese firms are ready and willing to do it because they see the future benefits. As an incremental process, respondents from all case companies did not perceive socially responsible activities as a burden to their companies because firms are flexible in the depth of implementation. They are willing to increase their investments in such

activities, with the financial development of their firms mostly due to reputation considerations and the potential financial gains.

Based on the findings, it is proposed that:

P6: The implementation of social practices is positively related to firm financial, environmental, social, and 3BL performance.

P7: Implementing social practices only has less positive impact on 3BL compared with implementing integrated LGS practices.

#### *5.5. The Synergistic Effect of Lean and Green, Green and Social, and Lean and Social Practices on Performance*

A number of researchers have attempted to take lean and green practices collectively to study their effects on various aspects of firm performance [54,63,67]. Lean and green practices facilitate each other in certain ways [54] and jointly contribute to a better competitive advantage and profitability [63]. This idea is confirmed by our findings. From case studies, we found that the correlation between lean and green combination and firm performance is high, indicating that the simultaneous implementation of lean and green practices by firms is an important way to pursue sustainability. The performance outcome is far more ideal than with the sole implementation of lean. As a result, if a firm is implementing lean practices, it would be better for it to also include certain green practices to achieve higher 3BL performance.

Green and social practices have long been regarded as sustainable business initiatives by researchers. Consistently, our findings show that green and social practices collectively are highly correlated with 3BL performance individually and collectively. Since the environment is part of CSR, as indicated in the definition [37], green and social practices are closely related to each other. For instance, when a company makes efforts to minimize the negative environmental impact, the stakeholders benefit. However, it is noteworthy that social practices include much more than just environmental issues, and each stakeholder group (employees, customers, business partners, the community, *etc.*) requires unique care from the company.

Very few researchers have taken lean and social practices into account in a single study so far. Existing works on lean and social practices mainly focus on the impact of lean on employees [18]. Other stakeholder groups such as customers, business partners, the society, *etc.* are largely overlooked. However, our findings may suggest a relatively new direction for future sustainability research. As the results show, a combination of lean and social practices significantly relates to enhanced 3BL performance. But it should be noted that, according to Figure 2, the correlation between the lean-social combination and environmental performance is lower compared with other aspects or combinations of 3BL performance. This indicates that even though social practices may to some extent include environmental issues, specific environmental initiatives are still needed for companies.

P8: The synergistic implementation of any two of lean, green, and social practices is positively related to firm financial, environmental, social, and 3BL performance.

P9: The synergistic implementation of any two of lean, green, and social practices has less positive impact on 3BL compared with implementing integrated LGS practices.

### 5.6. The Role of Firm Size and Age in Sustainability Development

From the findings, it appears that Company A has the highest level of LGS implementation and 3BL performance, followed by Companies C and B. It is worth noting that this order is exactly the same as the order of company size (measured by the number of employees) and firm age. This result is consistent with Shah and Ward [16], who found empirically that firm age and size are important factors in lean implementation. The same is true in a sustainability context. According to the respondent from Company A, the company will continue to increase its coverage and depth of green and social practices as it grows because it needs to pay back the society after getting various resources from it. The respondent views the operations of the firm as a process of getting resources from the society, creating value, paying back the society, and getting more resources. With respect to lean practices, the respondent expressed that lean is all about the continuous pursuit of zero waste. Like green and social practices, lean is also a never-ending journey which grows with the company. As a result, we suggest these two factors should be controlled in quantitative tests because they may significantly influence the results.

## 6. Conclusions, Limitations, and Future Research

Lean, green, and social practices and their impacts on various aspects of firm performance have been well studied in different contexts and in isolation. However, from a sustainability perspective, there is a need to take these practices collectively into account to form a more comprehensive framework. To address this gap, we integrated these practices and empirically investigated the relationship between the integrated LGS practices and 3BL performance in the Chinese auto fashion context. Findings suggest that lean, green, and social practices individually have a significantly positive effect on firm 3BL performance; however, the optimal 3BL performance can be achieved from a harmonious combination of these practices. Besides, firm size and age influence the level of implementation of lean, green, and social practices as well as their performance outcomes. Based on the empirical findings, we developed propositions for future quantitative tests. Partial implementation of any two of lean, green, and social practices has significant effects on 3BL. In addition, our study precisely supports the improvement in 3BL performance during different phases of LGS practices implementation. Our findings in this study will be an eye opener in the future for managers to integrate the best practices from each category to realize the 3BL performance as well as convince various stakeholders.

This study is not without limitations. Firstly, the current research is based on case studies, and results generated from case studies have limited generalizability. Having acknowledged this limitation, however, this case study provides the best possible means for obtaining the in-depth knowledge needed to develop and address the research propositions. Despite the study being in the Chinese context, its framework and methodology can be applied to other industrial contexts such as shipping and transport logistics. A larger sample size is required to validate our framework. Secondly, as lean, green, and social practices have differences and overlaps, more in-depth studies are needed to analyze these practices to identify a harmonious combination of them to achieve the optimal sustainable performance. Thirdly, this study focuses only on the fashion auto-parts sector; more studies are needed to see if the results can be extended to focal companies and the automotive industry as a whole. Lastly,

this research proposes a novel way to study corporate sustainability by incorporating lean, green, and social management systems. However, the impact of each individual system on the 3BL performance of firms should draw more attention from sustainability researchers in the future.

### Author Contributions

This paper is a joint work of the six authors. Lin Wu was responsible for data collection and initial draft preparation in consultation with others. Coding and analysis was done by Nachiappan Subramanian. Nachiappan Subramanian, Muhammad D. Abdulrahman and Chang Liu worked closely along with Lin Wu on both writing and the two rounds of revision. Kee-Hung Lai, as the corresponding author, in addition to the communications, reviewed the writing and revision of each version. Kulwant S. Pawar was responsible for reviewing overall progress at various stages, proof reading and commenting on each version of the paper.

### Appendix

**Table A1.** A summary of structured and open questions.

<b>Beginning Questions</b>	
Is your company currently implementing lean practices?	
Is your company currently implementing green practices?	
Is your company currently implementing social practices?	
<b>Structured Questions</b>	
<b>LGS Practices Implementation</b>	
JIT	<ul style="list-style-type: none"> <li>• Lot size reductions</li> <li>• JIT/continuous flow production</li> <li>• Pull system</li> <li>• Cellular manufacturing</li> <li>• Cycle time reductions</li> <li>• Focused factory production systems</li> <li>• Agile manufacturing strategies</li> <li>• Quick changeover techniques</li> <li>• Bottleneck/constraint removal</li> <li>• Reengineered production processes</li> </ul>
TQM	<ul style="list-style-type: none"> <li>• Competitive benchmarking</li> <li>• Quality management programs</li> <li>• Total quality management</li> <li>• Process capability measurements</li> <li>• Formal continuous improvement program</li> </ul>
TPM	<ul style="list-style-type: none"> <li>• Predictive or preventive maintenance</li> <li>• Maintenance optimization</li> <li>• Safety improvement programs</li> <li>• Planning and scheduling strategies</li> <li>• New process equipment or technologies</li> </ul>
HRM	<ul style="list-style-type: none"> <li>• Self-directed work teams</li> <li>• Flexible, cross-functional workforce</li> </ul>
Raw materials	<ul style="list-style-type: none"> <li>• Reduce raw material quantity</li> <li>• Reduce raw material variety</li> <li>• Avoid hazardous/harmful/toxic materials</li> <li>• Others, please specify</li> </ul>



Table A1. Cont.

<b>LGS Practices Implementation</b>	
Emissions and discharges	<ul style="list-style-type: none"> <li>• Reduce emissions</li> <li>• Reduce discharges</li> </ul>
Recycling	<ul style="list-style-type: none"> <li>• Solid wastes</li> <li>• Packages</li> <li>• Wastewater</li> <li>• Others, please specify</li> </ul>
Waste management	<ul style="list-style-type: none"> <li>• Prevention</li> <li>• Reduction</li> <li>• Management</li> </ul>
Employee-related social practices	<ul style="list-style-type: none"> <li>• Employee welfare</li> <li>• Employee training and self-development</li> <li>• Equality (the female, the disabled, the minority)</li> <li>• Working and living conditions improvement</li> <li>• Employee satisfaction</li> </ul>
Customers-related social practices	<ul style="list-style-type: none"> <li>• Quality of the products</li> <li>• Customer care</li> <li>• Customer education</li> <li>• Customer satisfaction</li> </ul>
Business partner-related social practices	<ul style="list-style-type: none"> <li>• Fair and transparent transactions</li> <li>• Education</li> <li>• Effective communications</li> </ul>
The community-related social practices	<ul style="list-style-type: none"> <li>• Philanthropic activities</li> <li>• Please give examples</li> </ul>
<b>3BL Performance</b>	
Financial performance	<ul style="list-style-type: none"> <li>• ROA</li> <li>• ROS</li> <li>• Cost reduction &amp; sales increase from sustainable practices</li> </ul>
Environmental performance	<ul style="list-style-type: none"> <li>• Reduction of air emissions</li> <li>• Reduction of wastewater generation</li> <li>• Reduction of solid waste disposal</li> <li>• Reduction of consumption of hazardous/harmful/toxic materials</li> <li>• Reduction of energy consumption</li> </ul>
Social performance	<ul style="list-style-type: none"> <li>• Improvement of social reputation</li> <li>• Improvement in number of social awards</li> </ul>
<b>Open Questions</b>	
<p>What motivates your company to implement lean practices?</p> <p>What are the benefits of implementing lean practices in your company? Please give a few examples.</p> <p>What are the major challenges of implementing lean practices in your company?</p> <p>Does your company intend to further expand the implementation of lean practices in the near future?</p> <p>What additional aspects of lean practices do you plan to implement in the near future and why?</p> <p>Note: These interview questions were repeated serially for green and social practices respectively.</p> <p>How would you prioritize lean, green, and social practices based on their (perceived) importance/benefit to your company?</p>	

## Conflicts of Interest

The authors declare no conflict of interest.

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