A Two-dimensional, Two-level Framework for Achieving Corporate Sustainable Development: Assessing the Return on Sustainability Initiatives

Abstract

Sustainability studies in operations management have reported the positive effects of lean, green, and social management systems on various dimensions of a firm's sustainability performance. However, despite its high importance and relevance, the time dimension of sustainability has not been systematically considered. This paper re-categorizes the well-identified sustainability initiatives based on a time dimension and empirically validates the categorization. Structural equation modeling (SEM) analyses were performed using data collected from 284 Chinese automotive firms. The results suggest that various lean and reactive green practices can be categorized as "short-term sustainability initiatives" because the effects of implementing these practices can be seen in a short period of time. Specifically, the benefits of implementing short-term sustainability initiatives can be further strengthened and reinforced in the long run by implementing corporate social responsibility (CSR) practices. In addition, our findings also demonstrate that to fully realize the potential associated with CSR practices, firms need to be long-term oriented and adopt a wait and watch approach.

Keywords: Sustainability/sustainable development, sustainability performance measurement, structural equation modeling (SEM)

1. Introduction

Sustainability has been an important topic in business practice and in academia (Linton et al., 2007). The importance of sustainability considerations in the corporate sector is well evidenced by the voluntary development of a range of sustainability initiatives by and for corporations (Lozano, 2012). These voluntary initiatives include cleaner

production, corporate citizenship, and corporate social responsibility, among others (Lozano, 2012). From an academic perspective, researchers have committed significant attention to the examination of the effects of sustainability initiatives on a range of performance dimensions (Gimenez et al., 2012; Schrettle et al., 2014), and have found mixed results (Schrettle et al., 2014).

Firms are always facing resource constraints, which forces them to be strategically selective in adopting sustainability initiatives. On the one hand, firms attempt to secure benefits by investing in sustainability initiatives that can bring immediate effects. On the other hand, with an increasing level of sustainability consciousness in society, firms cannot afford to overlook future prosperity. Therefore, most firms are faced with the strategic challenge of maximizing short-term benefits while paving the way for future development. Firms are therefore facing a difficult task of finding ways to maintain a proper balance between these two competing tasks.

Although the relationship between sustainability initiatives and different dimensions of firm performance has been extensively studied, the time dimension of sustainability has not been adequately addressed. This paper aims to fill this important research gap by re-categorizing the well-acknowledged sustainability initiatives based on the length of time needed for such practices' potential benefits to be realized. Based on the categorization of practices and performance measures, a two-dimensional, two-level sustainability framework incorporating both short- and long-term dimensions of sustainability is developed.

This paper proceeds as follows. Through a systematic review of the sustainability literature, Section 2 summarizes the theoretical basis of the sustainability framework we aim to develop, as well as the well-acknowledged sustainability practices. Hypotheses are then developed for empirical testing. Following that, Section 3 introduces the research methodology and the survey background. Data analysis and results are also presented. Based on the previous sections, Section 4 holds a discussion on the research findings. The last section, Section 5, talks about the implications and contributions of the study, and concludes the paper with limitations and possible future

research directions.

2. Theoretical background

2.1. Sustainability/sustainable development and the time dimension

The World Commission on the Environment and Development (WCED) broadly defines sustainability as "development that meets the needs of the present generation, without compromising the ability of future generations to meet their own needs" (WCED, 1987). Since the WCED's definition, sustainability has gained attention from business practitioners. Accordingly, corporate sustainability is defined as "development that meets the needs of a firm's direct and indirect stakeholders (such as shareholders, employees, clients, pressure groups, the local communities, etc.), without compromising its ability to meet the needs of future stakeholders" (Dyllick and Hockerts, 2002). A sustainable company is therefore one that is able to generate profit for its shareholders while protecting the natural environment and society. This explains the commonly acknowledged three dimensions of sustainability: environmental integrity, economic prosperity, and social equity (Bansal, 2005). According to Bansal (2005), sustainability can only exist at the intersection of these three dimensions. Based on the three-dimensional perspective, corporate sustainability is viewed as the triple bottom line (3BL) (Elkington, 1998). A truly sustainable organization is expected to be able to address the economic, environmental, and social requirements simultaneously (Elkington, 1998), which is a highly complex situation full of tension (Hahn et al., 2014).

The three-dimensional perspective has thus far dominated management sustainability research. Researchers focus on the environmental or social dimension to identify its relationship with the economic dimension (Gimenez et al., 2012). A key issue with regard to the three-dimensional perspective of sustainability in academic research is that the future is not considered. For example, when studying the impact of sustainability initiatives on firm performance, researchers tend to overlook the time

length required for the impact to be realized. In the business context, any practice requiring a long run before a positive effect on performance can be realized is not likely to be a strong motivation for a firm to invest resources to implement. It is within this background that this study aims to develop a novel framework, one where time is a major factor to be considered in sustainability-related organizational decision-making.

The importance of the time dimension in sustainability has been recognized (Dyllick and Hockerts, 2002; Hörisch et al., 2014; Lozano et al., 2015). Dyllick and Hockerts (2002) suggest that a two-dimensional perspective consisting of short-term survival and long-term prosperity is important to understanding the concept of sustainability. Similarly, Lozano et al. (2015) propose that sustainability should be a four-dimensional construct by including the time dimension. Hörisch et al. (2014) acknowledge the necessity for the co-existence of both short-term and long-term perspectives in a sustainable enterprise. A truly sustainable organization is capable of "addressing short-term as well as long-term problems and to offer companies short-term as well as long-term potentials and opportunities" (Hörisch et al., 2014, p.333). Implementing both short-term and long-term sustainable initiatives allows firms to effectively increase short-term earnings, and at the same time, protect the environment and their social integrity (Chang and Kuo, 2008). A recent empirical study conducted in the Malaysian manufacturing sector found that not all sustainable manufacturing practices have immediate positive effects on the three dimensions of sustainability performance (Abdul-Rashid et al., 2017), indicating a need to include a time dimension in future empirical studies on sustainability. However, how it can be included remains a challenge for researchers, and our study aims to narrow this gap.

Literature suggests different perspectives from which corporate sustainability has been seen (Moon et al., 2014). For example, Hahn et al. (2010) hold a trade-off viewpoint that acknowledges tensions among the three dimensions of sustainability and emphasizes that firms will need to make careful decisions on which dimension to achieve at the expense of others when they implement sustainability programs. On the other hand, a large body of studies on the so-called business case for sustainability take

a win-win perspective that holds that true sustainability can only be found in the intersection of the economic, environmental, and social dimensions of sustainability (Hart and Milstein, 2003; Kurapatskie and Darnall, 2013). However, a fact that seems not to be fully addressed by either approach to understanding sustainability is that the positive effect of some sustainability activities on performance occurs over time. Therefore, when a particular sustainability practice does not appear to contribute to firm's performance immediately after its implementation, it does not emphatically imply that such practice is of no value in terms of sustainability. It simply implies that the effect is premature now and can only be realized in the long run upon maturity. It is based on this that we propose the time dimension of sustainability be taken into consideration in sustainability-related studies.

2.2. Theoretical background

This study aims to establish a two-dimensional, two-level sustainability framework that incorporates both short- and long-term sustainability activities and performance. This new sustainability framework has a solid theoretical basis. "Two-dimensional" means that both short- and long-term sustainability practices and performance are considered, which is supported by the Chinese traditional philosophy of Yinyang as well as organizational ambidexterity. "Two-level" refers to the direct impact of sustainability practices on performance, supported by the practice-based view (PBV) of the firm. The theoretical basis of the new sustainability framework is summarized in Table 1.

Table 1: The two-dimensional, two-level sustainability framework

Definition and theory	Two dimensions	Two levels
What does it mean?	(1) Short-term sustainability (2) Long-term sustainability	(1) Sustainability practices (2) Sustainability performance
Theoretical basis?	Yinyang philosophy Organizational ambidexterity	The practice-based view (PBV)

2.2.1. The practice-based view (PBV)

The sustainability initiatives discussed in this study are "practices" in nature. According to Wu et al. (2010), practices are like recipes: They are publicly available standard

procedures to which firms have equal access. The varying levels of implementation of the same practice by different firms reflects different degrees of resource commitment and capabilities. A large body of operations management (OM) literature provides empirical evidence that the effective implementation of some practices leads to tremendous performance improvement (Yang et al., 2011; Hajmogammad et al., 2013). In the context of OM research, Bromiley and Rau (2014) believe that a practice-based view (PBV) is more applicable than the resource-based view (RBV), as the former depicts a direct relationship between practices and performance. As pointed out by Bromiley and Rau (2016, p. 101), "due to bounded rationality, firms often do not know of and/or do not use all the techniques that might benefit them." Consequently, performance can be partially explained by "imitable activities or practices, often in the public domain, amendable to transfer across firms" (Bromiley and Rau, 2014, p. 1249). This study develops the PBV in a specific context of sustainability with an additional element of time, and the PBV supports the "two-level" aspect of the sustainability framework.

2.2.2. Yinyang philosophy and organizational ambidexterity

Categorizing practices or performance into two levels in this study is based on traditional Chinese Yinyang philosophy and the important business strategy concept of organizational ambidexterity. Based on the ambidextrous thinking of both theories, short-term sustainability and long-term sustainability should coexist in any organization, and they complement and reinforce each other.

2.2.2.1. Yinyang philosophy

Figure 1 symbolizes Yinyang thinking. The overall circle, made up of black and white, represents everything in the world. The black half is called Yin and the white half Yang. Yin and Yang are two opposite cosmic energies, with Yin being feminine in nature and Yang masculine (Fang, 2011). Examples of Yin include women, the moon, night, weakness, darkness, softness, etc. On the contrary, men, the sun, day, strength, brightness, and hardness belong to Yang energies. There is a black dot in the white area

and a white dot in the black area, meaning that each of them exists in the other and they both coexist with everything in the world. The curved line between Yin and Yang indicates that there is no absolute separation between them. The curve creates a dynamic feel, meaning that Yin and Yang keep changing to the form of each other (Fang, 2011).

The Yinyang perspective "integrates 'either/or' with 'both/and' for permanent 'either/and' in relative terms" (Li, 2012, p.865). According to Fang (2011), the Yinyang principle suggests three philosophical underpinnings: 1) Yin and Yang coexist in everything, and everything embraces Yin and Yang; 2) Yin and Yang complement and reinforce each other; and 3) Yin and Yang exist within each other and interplay with each other to form a dynamic and paradoxical unity.

In the context of sustainability, long- and short-term practices can be represented by Yin and Yang. They coexist in all organizations, competing with each other for resources. Since it is usually easier for firms to see the benefits of implementing short-term sustainability practices, they tend to focus most of their resources on such practices and neglect the long-term ones. However, with the development of sustainability-related regulations and increasingly conscious consumers, firms cannot afford to completely ignore long-term sustainability. As a result, how to balance short- and long-term sustainability like Yin and Yang to maintain a dynamic equilibrium is a challenge for firms.

Figure 1: Yinyang representation

2.2.2.2. Organizational ambidexterity

The central idea of organizational ambidexterity is that successful firms tend to be ambidextrous, which means that they are able to effectively exploit their current resources and capabilities to achieve short-term benefits not at the expense of long-term prosperity (Raisch and Birkinshaw, 2008). The origin of the concept is traced back to the early 1990s, when March (1992) first discussed explorative and exploitive activities in the context of organizational learning. In addition to organizational learning, so far, organizational ambidexterity has been widely studied in the contexts of innovation, organizational adaptation, strategic management, and organizational design (Raisch and Birkinshaw, 2008). However, less attention has been focused on sustainability-related organizational ambidextrous activities, especially when a time dimension is considered.

Organizational ambidexterity fits the context of sustainability (Du, Pan, and Zuo, 2013; Hahn el al., 2016). Previous studies tend to perceive economic sustainability as a competing task of environmental and social sustainability (Du, Pan, and Zuo, 2013). In this study, we view the three dimensions of sustainability as crucially important for the firm, and the competing elements being short- and long-term gains associated with different practices. Thus, short-term sustainability practices are less risky, smaller-scale improvements that are built on the firm's existing capabilities. Firms tend to find it easier to embrace these activities because they can easily justify the implementation, as these activities are closely related with production and competitive objectives (Searcy, 2016). The benefits of implementing such practices are relatively predictable and certain. On the other hand, long-term sustainability practices are more radical changes to what has been happening in the organizations, and the benefits associated are not foreseeable. Both types of practices are needed for firms to secure quick gains while paving ways for future prosperity.

Corporate sustainability, the Yinyang perspective, and organizational ambidexterity share some common features, of which the most critical one is the paradoxical thinking embedded. Under the philosophical guidance of Yinyang, organizations should consider properly balancing the short- and long-term

sustainability initiatives for better performance.

2.2.3. Categorization of sustainability practices

Several ways of categorizing corporate sustainability activities have been developed by previous studies. A widely used one is based on the 3BL perspective, where sustainability practices are seen as environmental and/or socially responsible practices (Pullman et al., 2009; Gimenez et al., 2012). More recently, based on the extent of improvements required, Kurapatskie and Darnall (2013) categorize sustainability activities into lower-order and higher-order practices. This categorization is built on Hart and Milstein (2003), with lower-order sustainability activities including pollution prevention and product stewardship and higher-order activities referring to clean technology and community focus (Kurapatskie and Darnall, 2013). Empirical findings from this study suggest that higher-order sustainability activities bring firms a higher average level of financial return (Kurapatskie and Darnall, 2013).

Similarly based on different objectives, Maletic, Maletic, and Comiscek (2016) distinguish two types of sustainability practices: sustainability exploitation and sustainability exploration. While the former is defined as "practices aimed at making an organization more efficient through incremental improvements in processes and outputs," the latter refers to practices "challenging existing sustainability solutions with innovative concepts and developing capabilities and competencies for sustainability-related innovation (Maletic, Maletic, and Comiscek, 2016, p.159). In this study, country of origin was found to influence the impact of sustainability practices on performance.

Our way of categorizing sustainability practices is based on the previous categorizations. The difference lies in the time dimension. A detailed explanation of the categorization is given below.

2.2.4. Defining short- and long-term sustainability initiatives and performance

In this study, we define short-term sustainability initiatives as practices whose appropriate implementation results in relatively quick benefits to the implementing firms. Thus, firms easily embrace and adopt such practices, because the desired benefits

of these initiatives can be realized in shorter periods of time and with less risk compared with other sustainability initiatives. Among the widely accepted sustainability initiatives, we found from literature that lean management practices and reactive environmental management practices are able to contribute to corporate performance in a shorter period of time.

Ahi and Searcy (2013) point out that a long-term focus is a crucial characteristic of business sustainability, which means that truly sustainable organizations never neglect long-term sustainability. Unlike short-term sustainability initiatives, long-term sustainability initiatives usually do not result in immediate realization of set objectives and goals (Wagner and Schaltegger, 2004; Ameer and Othman, 2012). Instead, it takes time and effort for firms to realize the desired effects of long-term sustainability practices implementation, and the process of realization involves a high level of uncertainty (Wang and Bansal, 2012). Based on literature, we found that proactive environmental management practices and socially responsible initiatives have such a tendency in affecting corporate sustainability performance (Wagner and Schaltegger, 2004; Ameer and Othman, 2012).

So far, the time dimension of sustainability has not been reflected by the performance indicators used in existing studies. Our study is built on the existing 3BL performance measures, but the measurement items are re-categorized based on a consideration of time. Accounting-based measures, such as return on assets (ROA) and return on sales (ROS), are appropriate to measure short-term financial performance because they indicate the efficiency of firms at using assets to create value, which reflects internal performance rather than external perceptions of performance (Inoue and Lee, 2011; Endrikat et al., 2014). Another aspect of short-term sustainability performance is compliance with environmental and safety regulations, as they affect firms' ability to survive.

On the other hand, according to Inoue and Lee (2011) and Endrikat et al. (2014), long-term financial performance can be best captured by market-based measures like Tobin's q, which estimates firms' future prospects, reflecting the notion of external

stakeholders. In addition to long-term economic performance, indicators also include the reduction of emissions, sewage, and energy consumption, and the improvement of stakeholder satisfaction and relations (Abdul-Rashid et al., 2017).

2.3. Hypothesis development

2.3.1. Short-term sustainability initiatives and performance

As summarized above, in this study, short-term sustainability practices mainly include lean management practices and reactive environmental management practices. The positive link between various lean practices and a firm's financial performance has been widely confirmed. Theoretically, lean practices enhance a firm's profit by systematically reducing waste from its operations and increasing its efficiency (Shah and Ward, 2003; Yang et al., 2011; Khanchanapong et al., 2014). Specifically, lean practices lower production costs and lead times and enhance process flexibility and quality performance by reducing process variability, scrap, and rework time (Ward and Zhou, 2006; Bortolotti et al., 2015). Labor productivity can also be enhanced by the implementation of the human aspect of the lean system (Lewis, 2000; Shah and Ward, 2003). The combination of lean practices and human resource practices, such as training and praise for successful lean milestones achieved, yields better performance results (Rodriguez et al., 2015).

Taiichi Ohno, who introduced the concept of TPS to the world, defined waste as anything that does not add value (Heizer and Render, 2006). Specifically, he identified seven categories of waste from production: overproduction, queues, transportation, inventory, motion, over-processing, and defective product (Heizer and Render, 2006). Lean production, as a collection of just-in-time (JIT), total productive maintenance (TPM), total quality management (TQM), human resource management (HRM), and many other tools and practices, aims to eliminate these forms of waste and to continue to make improvements. Firms will not gain optimal performance results if they implement these bundles of practices in isolation (Khanchanapong et al., 2014). JIT can solve the problems of overproduction, work-in-process inventory, unneeded

transportation, and queues by supplying the customer with the product they want at the time they want it, in the amount they want, thus reducing inventory cost (Demeter and Matyusz, 2011; Khanchanapong et al., 2014). The benefits of JIT include low costs and rapid response (Heizer and Render, 2006). TPM, as an approach to ensure fluent and reliable production, results in high utilization of equipment, tight scheduling, minimum inventory, and consistent quality demand reliability (Heizer and Render, 2006). It eliminates wastes of time and material from facility breakdown or workers' inappropriate operations and maximizes facility effectiveness throughout the entire life of the product (Demeter and Matyusz, 2011). TQM mainly aims to continuously improve and sustain quality products and processes (Demeter and Matyusz, 2011). Due to the importance of employees to organizations and the emphasis put on teams, HRM is supportive of the above three bundles (Demeter and Matyusz, 2011). All four bundles of lean practices have a central aim: to eliminate any form of waste; to lower costs; and to increase operational efficiency, each of which ultimately result in higher profitability.

Another element of short-term sustainability initiatives is reactive, basic-level environmental practices. Nowadays, both national and regional level environmental and safety regulations force firms to adopt reactive green and safety practices. According to Laosirihongthong et al. (2013), in Thailand, manufacturers place heavier emphasis on reactive environmental practices than on proactive practices, and the implementation of reactive environmental practices results in a significant improvement of short-term sustainability performance. As suggested by Sharma and Vredenburg (1998), the main benefit associated with the implementation of reactive environmental and safety practices is reduced risk of environmental accidents and fines. Combining various lean practices and the reactive environmental practices as short-term sustainability initiatives, the first hypothesis is proposed as follows:

H1: The implementation of short-term sustainability practices has a positive and significant effect on the short-term sustainability performance of the firms.

As management systems, in addition to the short-term benefits, lean and green initiatives are believed to contribute to the long-term sustainability performance of

firms. Short-term sustainability initiatives are not isolated practices, and the effect can be optimized when various practices are implemented in a proper and mutually facilitating way. In other words, the total effect can exceed the sum of individual effect when the so-called synergy is realized. For example, Galeazzo et al. (2014) found that the simultaneous implementation of lean and green practices maximizes the synergistic effects on a firm's financial and environmental performance. Similarly, Ng et al. (2014) provide empirical evidence that the simultaneous implementation of lean and green practices yields better performance outcomes than the sole implementation of each of them. Apart from the synergistic effect of different practices, each of the short-term sustainability practices has long-term effects on performance through various mechanisms. According to previous studies, both internal and supply chain environmental actions are found to have a positive impact on each of the 3BL through waste minimization and cost savings from resource reduction and efficiency (Gimenez et al., 2012; De Giovanni and Vinzi, 2012). Similarly, Hofer et al. (2012) found that the implementation of lean practices contributes to long-term financial performance, partially through enhanced inventory leanness. Thus, the long-term benefits associated with implementation are a result of the continuously realized synergetic effects of the practices and the accumulated short-term effects. The better and deeper a company is involved in short-term sustainability programs, the more benefits it achieves, because there will always be room for improvement.

Apart from the long-term financial and operational benefits, the successful implementation of short-term sustainability practices improves the non-financial aspects of long-term sustainability performance. Short-term sustainability practices enhance employee and customer satisfaction by HRM, TPM, and TQM programs (Sarkis et al., 2010; Martinez-Jurado and Moyano-Fuentes, 2014). Short-term sustainability practices strengthen stakeholder relations and enhance corporate image by engaging in responsible and fair transactions, complying with environmental regulations, and systematically reducing waste and pollution. As a result, this study proposes the following hypothesis:

H2: The implementation of short-term sustainability practices has a positive and significant effect on the long-term sustainability performance of the firms.

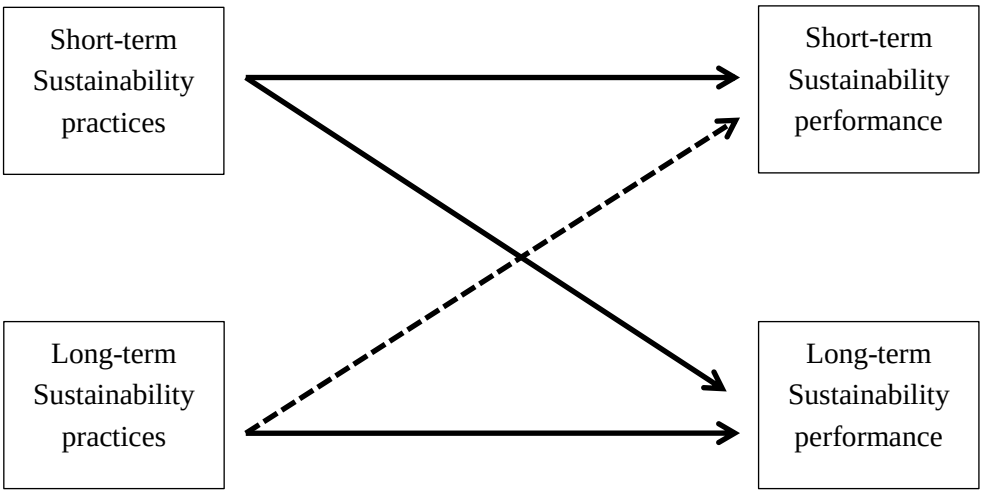
2.3.2. Long-term sustainability initiatives and performance

Long-term sustainability initiatives in this study mainly include proactive environmental practices and socially responsible practices. The main effects of these initiatives tend to be realized and visualized in the long run. Extra cost should be expected by firms from the implementation of long-term sustainability practices compared with non-adopters, because these activities require extensive resource investment (Bansal, 2005; Yang et al., 2011; Zhu et al., 2013). In the short run, such activities are less likely to contribute heavily to the enhancement of organizational performance, and even a negative effect could be expected (Yang et al., 2011; Lioui and Sharma, 2012). However, various benefits such as reduced cost, improved product differentiation, enhanced R&D capability, improved quality performance, minimized negative environmental impacts, and enhanced corporate social reputation can be achieved in the long run (Chang and Kuo, 2008; Pullman et al., 2009). According to Chang and Kuo (2008), Horvathova (2012), and Lo et al. (2012), there is a time lag (one to three years; different researchers report different findings) in the effect of long-term sustainability practices on performance. This indicates a win-win situation where superior sustainability performance can be achieved from the implementation of long-term sustainability practices in the long run. Thus, we propose:

H3: The implementation of long-term sustainability practices does not have a significant positive effect on the short-term sustainability performance of the firms.

H4: The implementation of long-term sustainability practices has a positive effect on the long-term sustainability performance of the firms.

Based on the PBV and the paradoxical thinking of the Yinyang perspective and organizational ambidexterity, summarizing the hypotheses developed above, we propose the conceptual framework, as shown in Figure 2:



(---: insignificant effect or significant negative effect; —: significant positive effect)

Figure 2: A two-dimensional, two-level sustainability framework

3. Methodology

3.1. Data collection

A survey instrument (Appendix A) was designed and distributed to automotive companies listed in an automotive company directory containing the names and contact information of 1,911 Chinese automotive firms. The directory was obtained from a professional automotive research website. Both emails and face-to-face approaches were employed for data collection. As a result, 284 usable questionnaires were collected, resulting in a response rate of 14.86%.

Measurement items in the questionnaire are derived from well-established scales with extensive applications in previous studies. Short-term sustainability measures are adapted from Shah and Ward (2007) and Jabbour et al. (2013). Long-term sustainability measures are developed from Gonzalez et al. (2008) and Gimenez et al. (2012).

Measures for short-term sustainability performance were adapted from Yang et al. (2011), Hajmohammad et al. (2013), Jabbour et al. (2014), and Fullerton et al. (2014). Accounting-based measures such as return on assets (ROA) and return on sales (ROS) are appropriate to measure short-term financial performance because they indicate the

efficiency of firms at using assets to create value, which reflects internal performance rather than external perceptions of performance (Inoue and Lee, 2011; Endrikat et al., 2014). The measures for short-term sustainability performance include ROA, ROS, profit, and environmental regulation compliance.

Long-term sustainability performance in this study is measured using items developed by Prajogo et al. (2012) and Lai et al. (2013). According to Inoue and Lee (2011) and Endrikat et al. (2014), long-term financial performance can be best captured by market-based measures like Tobin's q, which estimates firms' future prospects, reflecting the notion of external stakeholders. Other indicators include the development of products and processes with less negative environmental impacts, and the improvement of corporate image and stakeholder relations. Items used to measure short- and long-term sustainability initiatives and sustainability performance are summarized in Table 2. A 9-point Likert scale was used in the questionnaire, and each point was clearly defined. As the original measurement items are in English, a back-translation method was applied to ensure the Chinese version of the questionnaire is equivalent in meaning with no linguistic or cultural anomalies (Bhalla and Lin, 1987).

Table 2: Constructs, measures, and sources

Construct	Measures	Label	Source
Short-term sustainability practices	• JIT • Quality management • TPM • SPC • Flow • LCA • Internal environmental management policy	SP1 SP2 SP3 SP4 SP5 SP6 SP7	Shah and Ward (2007) Jabbour et al. (2013)
Long-term sustainability practices	• Systematic procedures for employee satisfaction improvement • Regular employee survey • Customer voice • Proactive development of green processes • Fair and transparent cooperation with suppliers	LP1 LP2 LP3 LP4 LP5	Gonzalez et al. (2008) Gimenez et al. (2012)

	• Care for the community and society	LP6	
Short-term sustainability performance	• ROA • ROS • Profit • Environmental regulation compliance	S1 S2 S3 S4	Yang et al. (2011) Hajmohammad et al. (2013) Fullerton et al. (2014) Jabbour et al. (2014)
Long-term sustainability performance	• Tobin's q • Cost savings achieved from environmental and social practices • Sales increase achieved from environmental and social practices • The development process with less environmental impact • The improvement of corporate image • Stakeholder relations	L1 L2 L3 L4 L5 L6	Lai et al. (2013) Prajogo et al. (2012)

The survey relies on subjective measures, given the limited availability of relevant objective data. Subjective measures are appropriate alternatives to their objective counterparts when there is difficulty in accessing the latter (Zulkiffli and Perera, 2011), and they do not necessarily yield less reliable results than objective data (Ward et al., 1998). However, efforts were still made to triangulate the data to check its credibility (Patton, 2002). In total, more than 40 respondents voluntarily provided company names (this is an optional question in the questionnaire), among which eight were found to have some relevant information publicly available. This objective information includes news from reliable sources, annual reports, CSR reports, and internal magazines. After careful comparisons, no inconsistency was identified between the subjective data provided by the respondents and the objective information obtained from public sources.

Table 3 summarizes the distribution of responses. In general, firms focus more heavily on the implementation of short-term sustainability practices (mean value: 7.19) than long-term sustainability practices (mean value: 6.52). In terms of perceived short- and long-term sustainability performance, the sample firms report a slightly higher level of long-term sustainability performance (mean value: 6.97) than short-term sustainability performance (mean value: 6.87).

Table 3: Distribution of responses

Construct	Measurement Items	Mean	Standard Deviation
Short-term sustainability practices	SP1	7.11	1.658
	SP2	7.33	1.472
	SP3	7.11	1.640
	SP4	7.39	1.366
	SP5	7.10	1.612
	SP6	7.12	1.624
Average		7.19	
Long-term sustainability practices	LP1	6.13	1.914
	LP2	6.10	1.896
	LP3	6.60	1.569
	LP4	7.04	1.495
	LP5	6.98	1.514
	LP6	6.29	1.893
Average		6.52	
Short-term sustainability performance	S1	6.68	1.690
	S2	6.58	1.701
	S3	6.63	1.635
	S4	7.57	1.480
Average		6.87	
Long-term sustainability performance	L1	6.72	1.568
	L2	6.83	1.573
	L3	6.84	1.560
	L4	7.08	1.426
	L5	7.37	1.584
Average		6.97	

Table 4 summarizes the general information of the sample firms, including location, number of employees, position of the respondents in their organizations, number of operating years, position of the firms in the automotive supply chain, and ownership types.

Table 4: Descriptive statistics

Location	**No.**	**%**	***No. of Employees***	**No.**	**%**
Northeast	26	9.2	<20	7	2.5
Bohai Sea	48	16.9	21-300	112	39.4

Yangtze River Delta	105	37.0	301-1000	86	30.3
South Central	23	8.1	1001-2000	30	10.6
Pearl River Delta	49	17.3	2001-3000	13	4.6
Southwest	26	9.2	3001-5000	6	2.1
Others	7	2.5	>5001	30	10.6
Total	284	100	Total	284	100
Ownership			***Age***		
State-owned	30	10.6	<1	1	.4
Private	183	64.4	1-5	17	6.0
Joint venture	48	16.9	6-10	71	25
Foreign	21	7.4	11-15	90	31.7
Others	2	.7	16-20	49	17.3
Total	284	100	21-25	25	8.8
Respondent Position			26-30	6	2.1
CEO	7	2.5	>30	25	8.8
Senior manager	62	21.8	Total	284	100
Junior manager	98	34.5	***Supply Chain Position***		
Department head	51	18.0	End assembler	54	19.0
Supervisor	34	12.0	Tier-1 supplier	135	47.5
Shop floor employee	16	5.6	Tier-2 supplier	77	27.1
Others	16	5.6	Others	18	6.3
Total	284	100	Total	284	100

3.2 Data analysis

Common method bias (CMB) and non-response bias (NRB) were checked. Before data collection, we made several efforts to minimize both types of bias, which include the establishment of construct validity, proper questionnaire design, the assurance of confidentiality, and proper incentives to respondents (Lambert and Harrington, 1990; Conway and Lance, 2010). Results are summarized in Tables 5, 6, and 7 respectively. According to Table 5 and Table 6, which summarize the result of an un-rotated EFA conducted with all the variables with eigenvalues greater than 1, the data set is suitable

of performing factor analysis. Seven factors emerge with the first factor explaining 36% of the total variance, indicating no problem of CMB influencing the results of the research.

Table 5: Results of Harman's single factor test

Indicator	Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	.935
Bartlett's Test of Sphericity Approx. Chi-Square	9903.149
df	1128
Sig	.000

Table 6: Total variance explained (Harman's single factor test)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	17.427	36.307	36.307	17.427	36.307	36.307	8.220	17.125	17.125
2	4.745	9.886	46.193	4.745	9.886	46.193	6.041	12.585	29.710
3	3.550	7.396	53.589	3.550	7.396	53.589	5.361	11.169	40.879
4	2.013	4.193	57.782	2.013	4.193	57.782	4.608	9.600	50.479
5	1.570	3.272	61.054	1.570	3.272	61.054	3.916	8.159	58.637
6	1.224	2.549	63.603	1.224	2.549	63.603	2.271	4.731	63.369
7	1.060	2.209	65.812	1.060	2.209	65.812	1.173	2.443	65.812

(Extraction Method: Principal Component Analysis)

In terms of NRB, data collected first and last were compared. One-way analysis of variance (ANOVA) was performed to check for the differences in objective information, such as company age, number of employees, and type of ownership among the three

groups. According to Table 7, all p values are greater than .05 (.949, .292, and .745), indicating that there is no significant difference among these two sets of data, and it is acceptable to combine them in this study.

Table 7: Results of ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
AGE	Between Groups	.265	2	.133	.053	.949
	Within Groups	708.900	281	2.523		
	Total	709.165	283			
EMPNO	Between Groups	6.459	2	3.229	1.238	.292
	Within Groups	733.259	281	2.609		
	Total	739.718	283			
OWNERSHIP	Between Groups	.345	2	.173	.295	.745
	Within Groups	164.317	281	.585		
	Total	164.662	283			

Structural equation modelling (SEM) is used for data analysis in this study. It was performed following the two-step approach suggested by Anderson and Gerbing (1988). IBM Amos for Windows version 22 was used to perform the SEM analysis.

Firstly, confirmatory factor analysis (CFA) is performed to assess the measurement model. During the CFA analysis, items with low factor loadings (lower than .5) were removed directly to ensure satisfactory model fit (Hair et al., 2010). As a result, SI1, SI2, LI4, SP4, LP1, and LP6 were deleted from further analysis.

Table 8: CFA results of research model 1

Latent variables	**Observed variables**	**Standardized factor**	**Cronbach's alpha**	**Composite reliability**	**Average variance extracted**

		loadings			**(AVE)**
Short-term sustainability initiatives	SI1 SI2 SI3 SI4 SI5 SI6 SI7	---- ---- .741 .795 .690 .765 .747	.864	.861	.549
Long-term sustainability initiatives	LI1 LI2 LI3 LI4 LI5 LI6	.881 .869 .700 ---- .704 .709	.881	.883	.603
Short-term sustainability performance	SP1 SP2 SP3 SP4	.899 .880 .886 ----	.918	.918	.789
Long-term sustainability performance	LP1 LP2 LP3 LP4 LP5 LP6	---- .822 .854 .761 .772 ----	.877	.879	.645

Table 9: Squared correlations among the constructs

	SP	LP	S	L
SP	1.00			
LP	.087	1.00		
S	.227	. 036	1.00	
L	.500	.138	.643	1.00

Reliability

Table 8 summarizes the Cronbach's α, composite reliability, and average variance extracted (AVE) values of the constructs. As can be seen in Table 8, Cronbach's α and composite reliability values for all four constructs are greater than the thresholds (Hair et al., 2010), suggesting sufficient reliability.

Construct validity

Convergent validity and discriminant validity are tested for construct validity. The fact that the AVE values for all constructs exceed .5 indicates adequate convergent validity.

The AVE values of the constructs are utilized to assess the discriminant validity. Discriminant validity can be established when the AVE value of a construct is greater than the recommended value of .5 and exceeds its squared correlations with other constructs (Azadegan et al., 2013). According to Table 8, the AVE values for all the constructs are greater than .5. Moreover, according to Table 9, discriminant validity can be established for all the constructs, as the AVE values are higher than its squared correlations with other constructs.

Fit indices

According to Hair et al. (2010), in addition to the construct validity, the measurement model validity should be assessed based on the goodness-of-fit (GOF). As indicated in

Table 10, the p value for χ^2 is significant (.000), Normed χ^2 is 2.005, CFI is .962 and RMSEA is .060, which meet the requirement for good model fit.

Table 10: GOF indices of the measurement model

	χ^2	Normed χ^2	CFI	RMSEA
The measurement model	226.524	2.005	.962	.060

Table 11: GOF indices of the structural model

	χ^2	Normed χ^2	CFI	RMSEA
CFA model	375.042	3.261	.913	.089

The second step of the SEM analysis is the assessment of the structural model. Table 11 summarizes the fit indices of the structural model. As can be seen, χ^2 is significant at a p value of .000. Normed χ^2 is 3.261. CFI is .913 and RMSEA is .089.

Table 12: Direct relationships between sustainability practices and performance

Hypothesis	Structural path	Estimate	Standardized error	t-value	Result
H1	SP→S	.548***	.081	8.363	Supported
H2	SP→L	.735***	.070	10.246	Supported
H3	LP→S	.067	.064	1.178	Supported
H4	LP→L	.201***	.047	3.857	Supported

(*** p<.001; **p<.01; *p<.05)

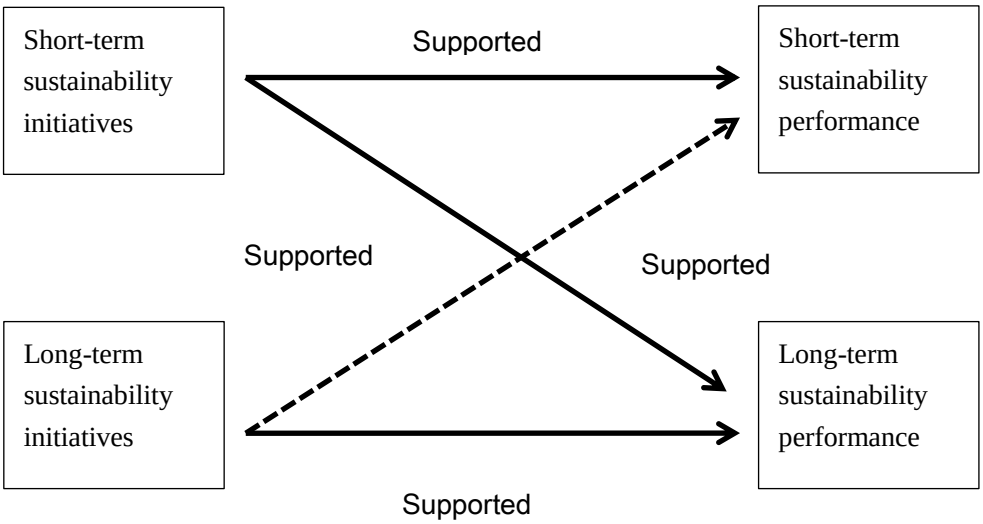


Figure 3: Hypotheses testing results

Table 12 and Figure 3 summarize the hypotheses testing results of the direct relationships between the independent variables and the dependent variables. H1 to H4 are all supported. As can be seen, the path coefficient between short-term sustainability practices and short-term sustainability performance is .548 with a p value less than .001, indicating a significant positive relationship between them. H1 is thus supported. The path coefficient between short-term sustainability practices and long-term sustainability performance is .735 with a sig. value less than .001, which also suggests a significant positive relationship between them. H2 is thus supported. In terms of H3, as shown in the table, long-term sustainability practices are not significantly related to short-term sustainability performance, with a path coefficient of .067 and a p value larger than .05, indicating a weak positive relationship between long-term sustainability practices and short-term sustainability performance. H3 is thus supported. The implementation of long-term sustainability practices, on the other hand, is positively associated with long-term sustainability performance with a path coefficient of .201 and significant value smaller than .001. H4 is also supported.

4. Research findings

It is not always possible for firms to realize the expected benefits of various sustainability initiatives within a certain amount of time after implementing these

initiatives. While some of them result in relatively quick effects, it takes firms a longer period of time to realize the benefits of others. Based on the time dimension of sustainability, our study categorizes the widely acknowledged sustainability practices into short-term and long-term ones. This time-based categorization is supported by the results of a large scale survey.

Based on the SEM analysis, we found a significant positive relationship between the implementation of short-term sustainability initiatives on both short- and long-term sustainability performance. In this study, short-term sustainability initiatives mainly include various practices in the lean management system, such as TPM, SPC, and flow, and basic environmental management practices, such as the application of LCA in product design and internal environmental policy. The effect of lean and green practices on firms' performance has been well studied (Rothenberg et al., 2001; King and Lenox, 2001; Lopez-Gamero et al., 2009; Yang et al., 2011; Alsmadi et al., 2012; Nawahir et al., 2012; Hajmohammad et al., 2013; Sambasivan et al., 2013; Verrier et al., 2014). This study differs from earlier studies in that it empirically investigates the effect of both lean and green practices on short- and long-term sustainability performance. Given the similarities shared by lean and green practices, the skills and know-how used to apply one can be readily and effectively shared in the implementation of the other (Hajmohammad et al., 2013). This enhances the efficiency of the implementation and shortens the time within which benefits are realized. As waste-reducing and productivity-enhancing activities, the implementation of short-term sustainability practices reduces costs and improves firms' profits in a relatively short time period (Yang et al., 2011). By systematically removing imperfections and inefficiencies, the implementation of such practices is expected to improve firm performance on a continuous basis (Alsmadi et al., 2012).

The operational and financial benefits of short-term sustainability practice implementation are also believed to sustain in the long-term, which is to a large extent due to difficulties in imitation caused by implementation complexity and the specific strategic environment (Martunez-Jurado and Moyano-Fuentes, 2014). Short-term

sustainability practices gradually streamline the processes and increase process consistency (Alsmadi et al., 2012). Researchers have identified a number of mechanisms, such as enhanced productivity and inventory leanness, through which short-term sustainability practices improve the operations and financial performance of the firm in the long run (Lewis, 2000; Hofer et al., 2012). The findings in this study are consistent with Fullerton et al. (2003) who found empirical evidence from their longitudinal study that firms implementing and maintaining lean practices enjoy sustainable financial rewards. As a whole management system consisting of various bundles of operational practices (Shah and Ward, 2003), the more deeply and systematically a firm engages in short-term sustainability, the more benefits it will gain as time goes by.

Long-term sustainability initiatives are found to be positively and significantly related with long-term sustainability performance. Their direct impact on short-term sustainability performance, however, is not significant. Long-term sustainability initiatives in this study mainly include stakeholder-related practices, such as the provision of self-development opportunities for employees, fair compensation for employees, systematic procedures for employee satisfaction improvement, employee survey, and caring the society at large. Such activities require extant prior investment and additional costs for execution with risks involved in terms of the expected financial returns (Barnett and Salomon, 2006). The result of this study is consistent with Surroca et al. (2010) who find no direct relationship between corporate responsibility and short-term financial performance. Similarly, Wang and Bansal (2012) find that new enterprises tend to mitigate the positive effects of CSR activities and intensify the negative, which results in overall negative effects on short-term financial performance. As suggested by Lu et al. (2014), the effect of social practices implementation on firm performance takes time to realize.

In the long run, firms can expect long-term financial gains to be achieved by the development of sustainable production processes, and a better corporate image by the implementation of long-term sustainability practices (Luo and Bhattacharya, 2006; Du

et al., 2011). This positive effect also comes from the synergistic effect of implementing different types of long-term sustainability practices aimed at different stakeholder groups. According to Barnett and Salomon (2006, p.1102), a firm can "attract resources, obtain quality employees, market its products and services, and even create unforeseen opportunities" by engaging in socially responsible practices. However, none of these benefits can be realized immediately after the implementation of these practices. Instead, a certain period of time is needed for the efforts to be seen and accepted by the stakeholders and translated into both tangible and intangible outcomes.

5. Conclusion and implications

Our research found empirical evidence for the two-dimensional, two-level sustainability framework which incorporates both short- and long-term sustainability initiatives and short- and long-term sustainability performance. The implementation of short-term sustainability initiatives was found to be significantly associated with the improvement of both short- and long-term sustainability performance. Further, the implementation of long-term sustainability practices contributes significantly to the enhancement of long-term sustainability performance. Its short-term effect, however, is insignificant.

This study contributes to the sustainability literature by adding the previously missing time dimension in an empirical way. This study reviews and re-categorizes the popular sustainability initiatives identified from the literature into short- and long-term sustainability initiatives. The rationale is that if firms can realize the desired benefit of implementing a certain initiative in a relatively short period of time, this initiative is referred to as a short-term sustainability initiative. On the other hand, if the effect of a certain practice can only be realized in the long-run with uncertainties involved, it is a long-term sustainability initiative. Practically, the categorization is useful in two ways. Firstly, among all the popular sustainability initiatives identified in the literature, which include various practices in the lean, green, and CSR management systems, firms have to make strategic choices by implementing some practices at the expense of others because of resource constraints. In this sense, this categorization of short-term and long-

term sustainability explains firms' preferences toward some sustainability practices over others. Secondly, in the current business environment where sustainability is increasingly emphasized, it is easier for firms to make strategic decisions on sustainability with a time dimension in mind. As short-term and long-term benefits are both crucial for the firms and society, with resource limits, how to balance the two could be difficult for firms as they need to survive the fierce competition in the present and leave room for future development. Thus, companies need clearer guidance on sustainability-related decision making.

This study is subjected to a number of limitations, each of which provides a possible direction for future research. First of all, the list of sustainability initiatives is composed based on a review of the existing literature. It may not be exhaustive. As a result, we suggest that future research make greater efforts to produce a more comprehensive sustainability initiatives list on which to apply the time dimension. Secondly, with respect with the time dimension of sustainability, longitudinal studies should be carried out to better capture the dynamics of sustainability initiatives and their effects on firm performance.

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Appendix A: The Survey Instrument

Dear participant,

The purpose of the survey is to identify the balance of short- and long-term sustainability practices to achieve short- and long-term performance.

To respond to this survey you should be at the management level and/or in charge of the operations in your organization. The survey would take roughly 30 minutes to complete. All responses will be held in strict confidence and no contact or company information will be traced to any individual or company and all reports will be generated in an aggregate fashion anonymously.

Many thanks for your support and cooperation!

Yours Sincerely,

Research team

Section A

Based on the reality and current practice in your organization, please indicate the extent to which you agree or disagree with the following statements (1 = very strongly disagree; 2 = strongly disagree; 3 = mildly strongly disagree; 4 = disagree; 5 = neither disagree nor agree; 6 = agree; 7 = mildly strongly agree; 8 = strongly agree; and 9 = very strongly agree)

A1: We produce on a JIT basis

A2: We undertake programs for quality improvement and control

A3: We have systematic procedures to ensure all equipment are under regular maintenance

A4: We make extensive use of statistical techniques to reduce process variance

A5: Our equipment is grouped to produce a continuous flow of families of products

A6: We use Life Cycle Analysis (LCA) for product design

A7: We have clear environmental management policy

Section B

Based on the reality and current practice in your organization, please indicate the extent to which you agree or disagree with the following statements (1 = very strongly disagree; 2 = strongly disagree; 3 = mildly strongly disagree; 4 = disagree; 5 = neither disagree nor agree; 6 = agree; 7 = mildly strongly agree; 8 = strongly agree; and 9 = very strongly agree)

B1: We have systematic procedures to improve employee satisfaction

B2: We conduct regular customer surveys to hear customer voice/concerns

B3: We have systematic procedures to take customer preference into our product development

B4: We are responsible for product quality throughout the product life cycle

B5: We work with our suppliers on a fair and transparent basis

B6: We make philanthropic donations to the society

Section C

Please indicate the extent to which your organization has experienced changes in the following aspects within one year of the implementation of the practices listed in

Sections A and B (1 = deteriorated more than 20%; 2 = deteriorated more than 15%; 3 = deteriorated more than 10%; 4 = deteriorated more than 5%; 5 = no change; 6 = improved by more than 5%; 7 = improved by more than 10%; 8 = improved by more than 15%; and 9 = improved by more than 20%)

C1: Return on assets (ROA)

C2: Return on sales (ROS)

C3: Profit

C4: Compliance with environmental regulation

Please indicate the extent to which your organization has experienced changes in the following aspects after one year of the implementation of the practices listed in Sections A and B (1 = deteriorated more than 20%; 2 = deteriorated more than 15%; 3 = deteriorated more than 10%; 4 = deteriorated more than 5%; 5 = no change; 6 = improved by more than 5%; 7 = improved by more than 10%; 8 = improved by more than 15%; and 9 = improved by more than 20%)

C5: Tobin's q

C6: Cost savings achieved from green and social initiatives

C7: Sales increase achieved from green and social initiatives

C8: The development of processes with fewer negative environmental impacts

C9: Improvement of corporate social image

C10: Improvement of stakeholder relations

Section D

Please fill or tick as appropriate

D1: Name of the enterprise (optional) _____

D2: Location of your company

D3: Your position in the company

D4: How long has the company been in business?

If you wish to receive a copy of the research findings, please leave your email address-_____.

Thanks again for your time and input!