Business Strong Sustainability Performance: Evidence from Food Sector

Ioannis E. Nikolaou and Thomas Tsalis

Abstract A composite sustainability index is suggested to evaluate strong sustainability of businesses by utilizing the triple-bottom-line approach and principles of strong sustainability. On the one side, the proposed index is classified into three classical aspects of sustainability to measure financial performance, environment protection, and social justice. On the other side, it focuses on some basic concepts of environmental science in relation to carrying capacity, safe minimum standards, and critical capital mainly to design certain thresholds for indexes which businesses should attain. An application of the proposed methodology has been made to the food industry in order to draw some implications useful to overcome some of the shortcomings of previous studies. The findings show that the idea of integrating economic, social, and environmental thresholds into corporate indicators might be a good basis to evaluate the strong corporate sustainability performance and offer a comprehend signal to stakeholders.

Keywords Corporate sustainability · Strong sustainability performance Composite sustainability index · Benchmarking/measuring systems

1 Introduction

The measurement of corporate sustainability has gained a great momentum in the last years. Many different methodologies have been suggested to measure corporate sustainability which could be classified into various categories based on measurement units, aspects of sustainability, and single or composite character of sustainability index (Searcy 2011; Goyal et al. 2013). The first category could be classified into three further types. The first type of methodologies put emphasis on corporate sustainability in financial terms (Atkinson 2000). The second type focuses on

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S. S. Muthu (ed.), *Quantification of Sustainability Indicators in the Food Sector*, Environmental Footprints and Eco-design of Products and Processes,
https://doi.org/10.1007/978-981-13-2408-6_1

nonfinancial terms to measure corporate sustainability (Epstein and Roy 2001) and the third type measures corporate sustainability in mixed terms (financial and nonfinancial) such as eco-efficiency and triple-bottom-line approach (Ilinitch et al. 1998; Nikolaou and Evangelinos 2012). Methodologies of the second category focuses on measuring different aspects of sustainability such as environmental performance, corporate social performance, corporate eco-efficiency performance, and triple-bottom-line performance (Wartick and Cochran 1985; Tyteca et al. 2002; Székely and Knirsch 2005; Nikolaou and Matrakoukas 2016). The final category emphasizes on corporate sustainability by utilizing either single indicators or composite indexes (Singh et al. 2007; Baumgartner and Ebner 2010).

Some important weaknesses of these methodologies are standardization and reliability. It is known that a general accepted methodology to measure corporate sustainability is a very complex task (Searcy 2012). Actually, the concept of corporate sustainability consists of various and complex meanings which are very difficult to be measured. Yet, in the case where scholars employ globally accepted guidelines (e.g., GRI, ISO 14031, and SA 8000) to measure corporate sustainability, this difficulty and complexity are being remained (Searcy 2009). The lack of appropriate information is another significant hinder for developing composite indexes, while many difficulties is arisen in the effort to select suitable corporate sustainability indicators since different corporate sustainability definitions lead to different aspects such as environmental sustainability, eco-efficiency, and triple bottom line (Schmidt et al. 2004; Brattebø 2005; Singh et al. 2007; Hubbard 2009).

Most of the previous methodologies pay more attention on measuring weak sustainability of businesses. It is rare to identify composite corporate sustainability indicator which takes into account the appropriate trade-offs among economic, environmental, and human capital (Faucheux and O'Connor 1998). Only a few studies have conducted to measure business strong sustainability by comparing the business sustainability scores with the average score of the sector. The majority of current methodologies are based mainly on the average score of a sector and not on the significant concepts of environmental science like carrying capacity, safe minimum standards, rebound effect, and critical capital (Figge and Hahn 2005; Van Passel et al. 2007).

To overcome some of these weaknesses, this book chapter develops a methodology to measure corporate strong sustainability by defining initially the content for each aspect of corporate strong sustainability. The innovation of this methodology is based on the combination of corporate performance scores with well-defined thresholds which are associated with basic principles of environmental science. Finally, a case study with three businesses in the food sector has been conducted.

This chapter is classified into four further sections. Section 2 analyzes corporate sustainability indicators and strong sustainability definitions. A description of the proposed composite sustainability index for businesses is presented in Sect. 3. A case study has been carried out in Sect. 4. Finally, a discussion, implications, and discussion for corporate strong sustainability have been described.

2 Theoretical Underpinning

Although the concept of corporate sustainability has been considered very significant, nevertheless, there is no consensus among scholars for this concept (Van Marrewijk 2003; Aras and Crowther 2008; Montiel 2008). So far, many scholars consider synonymous corporate sustainability and corporate social responsibility which focus on a triple goal strategy as follows: (a) economic viability, (b) environmental preservation and social justice (Van Marrewijk 2003). This implies that environmental and social strategy improves the profitability of businesses (Salzmann et al. 2005; Schaltegger et al. 2012).

However, a new theory for corporate sustainability is necessary in order to address more environmental and social side of sustainability and less financial side (Dyllick and Hockerts 2002). The majority of current theories for corporate sustainability are more close to business logic and less to sustainability idea (Lozano et al. 2015). Indeed, many theories focus on strategic management of businesses which deals with addressing of stakeholders' needs (stakeholder theory), creating competitive advantage (resource-based theory and knowledge-based theory), achieving social peace (legitimacy theory), and aligning with requirements of institutions (institutional theory) (Nikolaou 2017).

To evaluate corporate sustainability, many methodologies have been suggested according to a single or much components of sustainability (e.g., environmental, social, economic, and triple-bottom-line performance). The methodologies regarding corporate environmental sustainability methodologies have put emphasis only on measuring environmental aspects (e.g., air emissions and global warming), while methodologies of social issues focus on measuring social and ethical aspects (Veleva et al. 2003; Hutchins and Sutherland 2008). Some economic-based methodologies emphasize on identifying association between businesses financial figures and environmental and social strategies (Schaltegger et al. 2012). Some methodologies measure eco-efficiency performance or triple-bottom-line performance. Finally, there are two trends for methodologies in relation to the way in which they design indicators. The former category of methodologies provides sets of various single sustainability indicators and the later category offers composite sustainability indexes.

Some of the shortcomings for methodologies for single indicators are the absence of standardized indicators (Olsthoorn et al. 2001), the use of mixed units (Delai and Takahashi 2011), the various definitions for corporate sustainability (Delai and Takahashi 2011), the focus on particular business sector (Rahdari and Rostamy 2015), and the lack of leading and lacking sustainability indicators (Figge et al. 2002). The shortcomings of composite index methodologies are summarized as the unclear techniques to integrate single indicators as well as the lack of clear techniques to normalize the measurement units (Singh et al. 2007). Composite indexes have also high measurement complexity and great level of information losses in the procedures of integration (Salvati and Zitti 2009; Sridhar and Jones 2013). Subjectivity exists also on the procedures of evaluating weight factors which are required to incorporate single indicators into the final composite index (Shwartz et al. 2009). Moreover, the

majority of suggested composite indexes are not able to incorporate the concept substitution among three types of capital (e.g., economic, environmental, and human resources capital).

The substitution of three types of capital classifies businesses into two categories. In the first category, businesses contribute to week sustainability. The majority of relative literature and theories focuses on weak sustainability. Initially, stakeholder theory determines business sustainability with respect to the needs of stakeholders without taking account specific allocations among three types of capitals (economic, environmental and social) in order to be achieved the goals of strong sustainability (Steurer et al. 2005). Similarly, institutional theory points out that the businesses adopt sustainability practices mainly to align their strategies with the requirements of institutions and not to meet strong sustainability (Bansal 2005). The natural resource-based theory shows that sustainability practices offer only competitive advantage for businesses (Hart 1995; Hahn et al. 2010). The main focus of these theories is on strategic management and suffer from the lack of estimating any trade-offs between three types of capital. Some of these methodologies have been based on general accepted guides (e.g., GRI and ISO 14031) to measure corporate triple-bottom-line performance (Azapagic 2003, 2004; Isaksson and Steimle 2009) while some methodologies have been focused on two aspects of sustainability (financial and environmental) to measure corporate sustainability (Burritt and Saka's 2006).

The other trend puts effort to integrate concepts of substitutability and rebound effect into composite indicators. The idea of sustainability could be an outstanding chance for businesses to align their strategies with the requirements of regulators which are close to the goals of strong sustainability (Epstein and Roy 2001). Some scholars suggest that a sustainable organization should face natural environmental as one of the significant stakeholders whose requests could be reasons which organization should address (Stubbs and Cocklin 2008).

Businesses community should follow a new scientific paradigm in order to change their behavior in the general ecological system and natural environment (Stead and Stead 2000). For this purpose, businesses community should adopt a new green management paradigm with goals like protection of carrying capacity of the planet. In the field of corporate environmental management, the concept of strong sustainability includes primarily the ability of businesses to preserve environment resources constant with previous years (Bebbington and Gray 1997).

Finally, capital theory is utilized to explain the basic procedures of businesses to the road of strong sustainability. Particularly, the constant substitution among three types of capital should be the core strategy of businesses (Dyllick and Hockerts 2002). Finally, governmental policies should support the business initiatives to sustainable development, while society will consume sustainable to motivate businesses' sustainable practices (Málovics et al. 2008).

3 Methodology

This chapter is based on a multi-step measurement approach (Weber 2008; Bai et al. 2012). First, it designed a conceptual model to describe the main steps of research structure. Second, each step is clearly analyzed (Nikolaou and Kazantzidis 2016). To this end, Fig. 1 depicts a research structure which consists of four main tasks. In the first task, the corporate strong sustainability definition has been made. In the second task, some details have been given in relation to three aspects of corporate sustainability. These definitions are useful for the next task in which indicators will be designed to measure economic, environmental, and social sustainability. The final task provides methodological details to integrate single sustainability indicators in a composite index to estimate a final score for strong sustainability performance of businesses.

Task 1: A Definition for Corporate Strong Sustainability (Authors' Own)
Van Marrewijk (2003) describes various definitions for corporate sustainability. Many definitions have been suggested for corporate sustainability with emphasis on different aspects of sustainability. Indeed, some of these definitions have been focused mainly on social aspects such as corporate citizenship and business ethics. They explain the responsible activities of businesses through their efforts to behave as good citizens by embracing the ethical values of society (Joyner and Payne 2002). A quite widespread socio-ethical model is the pyramid of Carroll which includes four basic responsibilities for businesses: economic, legislative, ethical, and philanthropic (Carroll 1991).

Other corporate sustainability definitions pay more attention to environmental issues. By following classical Brundtland's definition for sustainable development, Labuschagne and Brent (2005) define corporate sustainability as the strategy of businesses to meet the needs of current generation without compromising the ability of future generation to meet their needs. Finally, some definitions focus on economic aspect of corporate sustainability by examining the influence of sustainability strategy on profits and shareholder value (Godfrey et al. 2009). However, a lot of corporate sustainability definitions have recently focused on triple-bottom-line

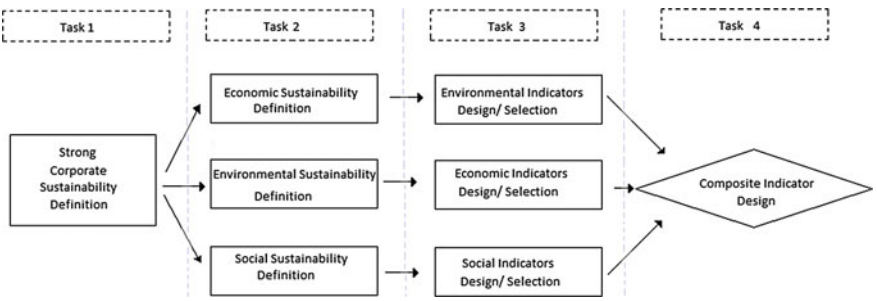

Fig. 1 The structure of the methodology

approach which implies simultaneously profits generation, progress in environmental performance, and ethical human resources management (Elkington 1998; Dyllick and Hockerts 2002).

Very little effort has been made on the field of corporate strong sustainability. The debate has limited more to ecological sustainability (van Weenen 1995; Wallner 1999) and failing to quantify thresholds for economic and social issues. The contemporary sustainable business models contribute to sustainable development in a relative way by measuring the continual improvement of sustainability performance among businesses (Málovics et al. 2008).

To this debate, a definition regarding strong sustainable business should be based on triple-bottom-line approach and well-defined thresholds for each aspect of sustainability. Therefore, sustainable businesses could be:

> these which invest successfully their profits and achieve simultaneously specific environmental and social objectives.

Task 2: Definitions of Three Aspects of Sustainability

In order this definition to be more useful, each aspect of sustainability should be measured. Hitherto, business economic sustainability is mainly measured through profits or shareholder values maximization. The profits cover various preconceptions since they are not able to respond clearly, if corporate sustainability practices improve profits or opposite. It is a high-risk approach to employ absolute figures of profits for measuring the financial performance of businesses because of its fluctuations might be a temporary consequence of the phase of business cycle. It is hard to describe an unsustainable period only using profits decreasing. Similarly, shareholder value is a limited indicator given that it covers only one group of stakeholders (shareholder) without examining many other necessary groups of stakeholders for sustainability performance. Thus, economic sustainability is defined as:

> the effective investment of financial capital of businesses in the long run period

The great part of current literature puts more emphasis on weak sustainability (free substitution among three types of capitals) and only a few studies examine environmental sustainability by suggesting renewable resources for firms. Bebbington and Gray (1997) have defined strong sustainability as the strategy of businesses to leave natural resources constant at an annual basis. Consequently, corporate strong environmental sustainability is defined as:

> their capability to work in an annually basis bellow specific thresholds which associated with basic environmental principles.

The last aspect, socially business sustainability focuses on protecting human rights and ethics. A classical definition for business social sustainability focuses on ethical issues of employees and needs of stakeholders (Wheeler et al. 2003; Aguilera et al. 2007). A distinction has been also made between the efforts of businesses to create social values both in inside and outside of business procedures. The social sustainability is defined as:

> the principles of equity and justice are successfully implemented by business community.

Task 3: Strong Sustainability Indicators Design

So far, there are two techniques to measure corporate sustainability performance. The former focuses on designing lists with single indicators suitable to measure each aspect of sustainability (Searcy 2012). The latter concentrates on developing composite indexes. Both techniques have some common flaws, especially, during the procedures of selecting indicators and connecting with the concept of strong sustainability (Singh et al. 2009; Hahn et al. 2010; Hediger 2010).

Many models have suggested determining the relationship between sustainability strategies and shareholders' value. The weaknesses of such financial indicators are focused first on the limited scope of shareholder idea (e.g., only a group of stakeholder idea) and second on unclear signal of profits as an absolute figure. Although many models have suggested determining the relationship between sustainability strategies and financial performance, nevertheless there are some weaknesses. One weakness is their focus only on the limited scope of shareholder idea (e.g., only a group of stakeholder idea). A second weakness is the unclear signal of profits as an absolute figure. A last but not least weakness of suggested financial indicators is the lack of consensus among scholars who provide various financial indicators (e.g., turnover ratio, average capital employed, total income or revenue, total costs, return on investment, and sales) and methodologies (Székely and Knirsch 2005; Singh et al. 2007; Dočekalová and Kocmanová 2016).

Taking into account these failures, it is suggested initially the Net Present Value (NPV) of profits (Table 1: Eq. 1) and furthermore, the classical Internal Rate of Return (IRR) to show the efficient way in which businesses invest their financial capital (Table 1: Eq. 2).

Additionally, in the context of strong sustainability, the financial aspect is necessary to be seen over a long-run period. To determine the rate of successful investment of firm, a threshold is necessary to be combined with IRR. Relative literature suggests Costs of Capital (CC) as a suitable indicator to compare with IRR. This combination shows the efficient investment of financial capital of

Table 1 Sustainability indicators under triple-bottom-line approach

Symbols	Equation	Number of equation	Details
NVP	$\text{NPV} = \frac{\sum_{i=1}^{t}(\text{B}_t - \text{C}_t)}{(1+r)^t} - \text{II}$	Eq. 1	Net present values B_t: benefits for year t, C_t: costs for year t, $\text{B}_t - \text{C}_t$: profits, r: discount rate, II: initial investment
IRR	$\frac{\sum_{i=1}^{t}(\text{B}_t - \text{C}_t)}{(1+\text{IRR})^t} - \text{II} = 0$	Eq. 2	Internal rate of return
ECO_I_t	$\text{ECO\_I}_t = \text{IRR}_t - \text{CC}_t$	Eq. 3	Economic indicator in time t, IRR_t: internal rate of return, CC_t: costs of capital
$\text{ENV\_I}_{i,t}$	$\text{ENV\_I}_{i,t} = \text{Trh}_{i,t} - f(\text{EP}_{i,t})$	Eq. 4	Environmental indicators i in time t, $\text{Thr}_{i,t}$: thresholds of i indicator in t time, $\text{f(EP}_{i,t})$: environmental performance of i indicator in t time
$\text{SOC\_I}_{j,t}$	$\text{SOC\_I}_{j,t} = f(\text{SP}_{j,t}) - \text{Trh}_{j,t}$	Eq. 5	Social indicators of j indicator in t time, $\text{Thr}_{j,t}$: thresholds of j indicator in t time, $f(\text{SP}_{j,t})$: environmental performance of j indicator in t time

businesses. Eq. 3 (Table 1) shows Economic Indicator (ECO_I). This shows that when IRR is greater than CC, then ECO_I (Economic Indicator) contributes positive to composite sustainability indicator and negative in the opposite case.

In the second aspect of sustainability, many indicators have been suggested to measure the environmental dimension. A significant failure of such indicators is their limitation on measuring weak sustainability (Málovics et al. 2008). Although some efforts have been made to measure strong environmental sustainability, nevertheless, they have achieved small progress in the field (Figge and Hahn 2004; Velena et al. 2003).

To overcome some failures of the previous methodologies, it is suggested environmental indicators (ENvironmental Indicators—$\text{ENV\_I}_{i,t}$) as combination of Environmental Performance (EP) of businesses for i indicator (e.g., air emission, water use, wastewater production) in t year with threshold for each indicator in t year (Table 1: Eq. 4). The influence of environmental indicators is zero on the composite index in the case where corporate environmental performance is equal to threshold. The business influence is positive in the composite index in the case where corporate environmental performance indicators are greater than thresholds and negative in the opposite case.

Similarly, Social Indicators (SOCial Indicators, $\text{SOC\_I}_{i,t}$) is estimated as an abstraction between Thresholds ($\text{Thr}_{i,t}$) and Social Performance of firms ($\text{SP}_{i,t}$) (Table I: Eq. 5). These indicators have a positive influence on composite index in the case when business social performance is greater to threshold and negative in the opposite case.

Task 4: A Composite Index for Business Strong Sustainability
To integrate business sustainable indicators to a composite sustainability index, some further mathematical transformations are necessary such as scores normalization, weight factors estimation, and composite index equation design.

Equation 6 shows the idea of normalized indicators: It converts scores of business sustainability indicators in a scale between −1 and 1. The score of each aspect of sustainability is converted by utilizing a specific mathematical equation (Table 2: Eqs. 6.1–6.3). Second, suitable weight factors are determined which are necessary to integrate single indicators to the composite index which is summed up to the unit (Table 2: Eq. 8). Third, it proposed Eq. 7 (Table 2) to integrate normalized indicators into composite indicator.

Finally, social indicator indicates business contribution to strong sustainability and it is ranged from −1 to 1. Negative scores [−1,0) indicate the business contribution to weak sustainability, while scores greater or equal to zero [0,1] means that businesses contribute to strong sustainability.

4 A Case Study: An Evidence from Food Industry

A case study is analyzed to test the validity of the proposed methodology. It aims to indicate the practicability of methodology to strong sustainability of firms (Nikolaou et al. 2013). The sample includes three businesses in the food sector. For confidential reasons, it omitted the names of businesses and it utilized only symbols B_1 (for Business 1), B_2 (for Business 2), and B_3 (for Business 3.) Starting from the economic aspect of sustainability, Table 3 shows economic performance indicators for sampled businesses during a period of 5 years (data emerged from sustainability and annual reports of businesses). The score of indicators is based on Eqs. 1, 2, 3, and 6.1. The final column shows normalized economic indicators for each firm per year.

Table 4 analyzes the final environmental indicators in comparison to thresholds in order to show how businesses reach the goals of strong sustainability. The results show that the majority of environmental indicators are greater to thresholds. Only, 5% of indicators achieve scores under thresholds (Thr) and equal to zero are 7% of indicators.

Table 5 illustrates the final score of business environmental indicator which is estimated as a product between normalized environmental scores and weight factors. It is significant to say that weight factors are emerged from a questionnaire-based survey in five experts in the field of corporate sustainability. 32% of environmental indicators contribute to the overall sustainability score.

Similarly, social indicators have been quantified by information which is drawn from sustainability and annual reports. Table 6 shows social indicators as abstraction between social performance indicators and thresholds. The findings show that most of the social indicators are greater to thresholds. This means that

Table 2 Composite sustainability index

Symbols	Equation	Number of equation	Details
$I_{i,t:\text{norm}}$	$\begin{cases} \frac{X_{i,t}}{X_{\max,t}}, & X>0 \\ 0, & X=0 \\ -\frac{X_{i,t}}{X_{\max,t}}, & X<0 \end{cases}$	Eq. 6	Normalized indicator i in period t X_i performance of firm $X_{\max,t}$ *is the max score of all indicators*
$ECO\_I_{i,}$ $_{t:\text{norm}}$	$\begin{cases} \frac{ECO\_I_{i,t}}{ECO\_I_{i,t,\max}}, & ECO\_I_i>0 \\ 0, & ECO\_I_i=0 \\ -\frac{ECO\_I_{i,t}}{ECO_{i,t,\max}}, & ECO\_I_i<0 \end{cases}$	Eq. 6.1	Normalized economic indicators $ECO\_I_{i,t}$ economic performance of business, $ECO\_I_{i,t,\max}$ the max score of economic performance
$ENV\_I_{l,}$ $_{t:\text{norm}}$	$\begin{cases} \frac{ENV\_I_{l,t}}{ENV\_I_{l,t,\max}}, & ENV\_I_{l,t}>0 \\ 0, & ENV\_I_{l,t}=0 \\ -\frac{ENV\_I_{l,t}}{ENV\_I_{l,t,\max}}, & ENV\_I_{l,t}<0 \end{cases}$	Eq. 6.2	Normalized environmental indicators $ENV\_I_{l,t}$ environmental performance of business, $ENV\_I_{l,t,}$ $_{\max}$ the max score of environmental performance
$SOC\_I_{f,}$ $_{t:\text{norm}}$	$\begin{cases} \frac{SOC\_I_{f,t}}{SOC\_I_{f,t,\max}}, & SOC\_I_{f,t}>0 \\ 0, & SOC\_I_{f,t}=0 \\ -\frac{SOC\_I_{f,t}}{SOC\_I_{f,t,\max}}, & SOC\_I_{f,t}<0 \end{cases}$	Eq. 6.3	Normalized social indicators $SOC\_I_{f,t}$ social performance of business, $ECO\_I_{i,t,\ \max}$ the max score of social performance
SBS_I_t	$\sum_{i=1}^{n} w_i ECO\_I_{i,t_{\text{normal}}} + \sum_{l=n}^{m} w_l ENV\_I_{l,t_{\text{normal}}} + \sum_{f=m}^{k} w_f SOC\_I_{f,t_{\text{normal}}}$	Eq. 7	Strong business sustainability index Sum of economic, environmental and social indexes
WF	$\sum_{i=1}^{n} w_i + \sum_{l=n}^{m} w_l + \sum_{f=m}^{k} w_f = 1$	Eq. 8	Weight factors

Table 3 Economic indicators' values (authors' own)

Businesses	Years	B_t	C_t	$B_t - C_t$	r	$1 + r$	$(B_t - C_t)/(1 + r)^b$	IRR[c]	$ECO\_I_t^d$	$ECO\_I_{t,normal}^e$
							−100,000			
B_1^a	1	22,000	15,300	6700	0.6	0.4	16,750	0	0	0
	2	23,000	16,500	6500	0.6	0.16	40,625	−38%	−0.98	0.98
	3	25,000	18,000	7000	0.6	0.064	109,375	8%	−52%	0.43
	4	25,500	22,000	3500	0.6	0.0256	136,718.75	46%	−0.14	0.20
	5	26,000	23,500	2500	0.6	0.01024	244,140.6	68%	0.08	0
							−100,000			
B_2^a	1	28,000	23,000	5000	0.6	0.4	12,500	0	0	0
	2	13,000	32,500	−19,500	0.6	0.16	−121,875	−8%	−0.52	−0.43
	3	35,000	32,000	3000	0.6	0.064	46,875	−1%	−0.59	0.36
	4	41,000	38,000	3000	0.6	0.0256	117,187.5	10%	−0.5	0.45
	5	41,500	37,500	4000	0.6	0.01024	390,625	10%	−0.5	0.45
							−100,000			
B_3^a	1	30,000	23,000	7000	0.6	0.4	17,500	0	0	0
	2	31,000	24,500	6500	0.6	0.16	40,625	0	0	0
	3	32,500	28,800	3700	0.6	0.064	57,812.5	−8%	−0.52	0.43
	4	34,300	30,000	4300	0.6	0.0256	167,968.75	−8%	−0.52	0.43
	5	37,200	34,200	3000	0.6	0.01024	292,968.75	23%	−0.37	0.57

[a]Businesses: F_1, F_2, F_3
[b]Eq. 1
[c]Eq. 2
[d]Eq. 3
[e]Eq. 6.1

Table 4 Environmental indicator scores (authors' own)

ENV_I[b]	Trh[c]	Years														
		B_1^a					B_2^a					B_3^a				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
ENV_I_1	0.54	0.12	0.03	0.05	0.03	−0.01	0.07	0.08	0.04	0.03	0.04	0.05	−0.01	0.05	0.06	0.05
ENV_I_2	0.51	−0.12	0.02	0.01	0.03	0.03	0.04	0.03	0.02	0.01	0.01	0.02	0.04	0	0.02	0.03
ENV_I_3	0.42	−021	0.01	0	0.02	0.03	0.01	0.02	0.02	0	0.02	0.02	0.01	0	0.04	0
ENV_I_4	0.32	−0.31	0	0.01	−0.04	0	−0.01	0	0.02	−0.02	0	0	0.01	0	0.02	0
ENV_I_5	0.41	0.22	0.01	0.03	0.04	0.02	0.03	0	0	0.01	0.02	0.03	0	0.03	0.01	0.02
ENV_I_6	1220	200	100	0	100	−100	220	190	210	207	200	190	100	0	−100	100
ENV_I_7	560	50	0	10	20	30	40	30	20	30	40	44	47	60	30	40
ENV_I_8	3302	290	210	110	280	0	110	210	120	0	300	290	280	310	110	220
ENV_I_9	36	5	3	4	2	4	3	2	1	6	4.5	3.5	2.5	7	5	4
ENV_I_{10}	58	5	4	3	2	4	5	6	7	4.5	4	5	3	6	7	6
ENV_I_{11}	27	5	3	2	1	0	3	2	4	3	2	1	3	6	4.5	4
ENV_I_{12}	18	2	1	2	2	3	2	1	3	4	3	2.5	2	1	0.5	2
ENV_I_{13}	14	1	0	−1	0	2	1	0	−0.5	−0.5	−1	−1.5	1	0	−1	−2
ENV_I_{14}	16	1	0	0.5	0.7	0.8	1	0.8	0.7	0.5	0.4	0.3	1	0.7	0.8	0.9
ENV_I_{15}	17	2	1.5	1.5	1.5	1	0	2	1.5	1.4	1.3	0	1	3	4	1
ENV_I_{16}	19	1	0	2	0.5	0.9	2	1.5	1	0.5	0.2	0.1	0	−1	1	0
ENV_I_{17}	212	12	0	20	9	7	5	0	−6	2	6	5	4	7	10	12
ENV_I_{18}	0.48	0.21	0.21	0	0.22	0.23	0.22	0.21	0.22	0	0.23	0.22	0.24	−0.21	−0.22	0.22
ENV_I_{19}	0.39	0.11	0.03	0.02	0.02	0.01	0.02	0.05	0.06	0.07	0.03	0.02	0.01	0	−0.01	0
ENV_I_{20}	222	18	10	10	18	17	30	25	19	18	13	17	18	19	18	40
ENV_I2_1	62	12	8	12	13	14	9	8	11	11	9	8	9	10	9	11
ENV_I_{22}	611	12	9	8	11	12	13	10	9	8	11	16	12	10	0	10

[a]Businesses 1, 2 and 3

[b]Environmental indicators

[c]Thresholds

Table 5 Final score of corporate environmental performance (authors' own)

	Businesses														
	WF	B_1^a					B_2^a					B_3^a				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
$ENV\_I_1^b$	0.02	−0.05	0.10	0.16	0.10	1.26	0.021	0.24	0.013	0.010	0.013	0.016	1.26	0.016	0.01	0.016
ENV_I_2	0.01	0.1	0.09	0.06	0.02	0.012	0.015	0.02	0.009	0.006	0.006	0.009	0.05	0.01	0.09	0.03
ENV_I_3	0.01	0.01	0.09	0.06	0.02	0.015	0.009	0.012	0.012	0.006	0.012	0.012	0.009	0.006	0.018	0
ENV_I_4	0.02	0.01	0.01	0.07	7.36	0.014	−0.010	0.014	0.021	−0.07	0.014	−0.03	0.017	0.014	−0.021	−0.010
ENV_I_5	0.09	0.05	0.03	0.07	0.09	0.005	0.007	0	0.001	0.003	0.005	0.007	0.001	0.007	0.003	0.005
ENV_I_6	0.01	0.02	0.02	0	0.02	−0.012	0.026	0.023	0.025	0.025	0.024	0.023	0.012	0	−0.01	0.012
ENV_I_7	0.01	0.02	0	0.02	0.05	0.007	0.010	0.007	0.005	0.007	0.010	0.011	0.011	0.015	0.007	0.010
ENV_I_8	0.01	0.07	0.02	0.06	0.06	0	0.006	0.012	0.006	0	0.017	0.016	0.016	0.018	0.006	0.012
ENV_I_9	0.02	0.04	0.07	0.01	0.03	0.010	0.007	0.003	0	0.017	0.012	0.008	0.005	0.021	0.014	0.010
ENV_I_{10}	0.06	0.03	0.02	0.01	0	0.002	0.003	0.004	0.006	0.003	0.002	0.003	0.001	0.004	0.006	0.004
ENV_I_{11}	0.09	0.07	0.04	0.03	0.01	0	0.004	0.003	0.006	0.004	0.003	0.001	0.004	0.009	0.006	0.006
ENV_I_{12}	0.01	0.05	0.01	0.05	0.05	0.008	0.005	0.001	0.008	0.012	0.008	0.006	0.005	0.001	0	0.005
ENV_I_{13}	0.01	0.01	0.009	0.04	0.09	0.018	0.013	0.009	−0.06	−0.006	−0.004	−0.002	0.013	0.009	−0.004	0
ENV_I_{14}	0.02	0.02	0	0.01	0.04	0.016	0.021	0.016	0.014	0.010	0.008	0.006	0.021	0.014	0.016	0.019
ENV_I_{15}	0.02	0.01	0.09	0.009	0.009	0.006	0	0.012	0.009	0.008	0.078	0	0.006	0.018	0.024	0.006
ENV_I_{16}	0.02	0.01	0.09	0.02	0.03	0.017	0.027	0.022	0.018	0.013	0.010	0.01	0.009	0	0.018	0.009
ENV_I_{17}	0.01	0.01	0.004	0.018	0.010	0.009	0.007	0.004	0	0.005	0.008	0.007	0.006	0.009	0.009	0.011
ENV_I_{18}	0.02	0.01	0.01	0.07	0.04	0.017	0.014	0.010	0.014	0.007	0.176	0.014	0.021	−0.003	0	0.014
ENV_I_{19}	0.02	0.06	0.02	0.09	0.09	0.006	0.009	0.018	0.021	0.024	0.012	0.009	0.006	0.003	0	0.003
ENV_I_{20}	0.02	0.09	0	0	0.07	0.006	0.018	0.03	0.008	0.007	0.002	0.006	0.07	0.008	0.007	0.027
ENV_I_{21}	0.01	0.04	0	0.08	0.10	0.012	0.002	0	0.006	0.006	0.002	0	0.02	0.004	0.002	0.006
ENV_I_{22}	0.01	0.01	0.10	0.09	0.12	0.13	0.014	0.11	0.010	0.009	0.125	0.018	0.13	0.011	0	0.011

[a]Businesses 1, 2 and 3

[b]Environmental indicators

Table 6 Social indicators in according to the thresholds[a] (authors' own)

	Businesses															
SOC_I_i^c	Trh	Years														
		B_1^b					B_2					B_3				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
SOC_I_1	0.4	0.05	0.15	−0.5	0	−0.2	−0.1	0.05	0.1	0.2	0.07	0.06	0.04	−0.1	−0.08	−0.1
SOC_I_2	0.6	0.05	−0.1	−0.3	0.07	0.06	−0.2	0.06	−0.1	−0.9	−0.1	−0	−0.2	0.06	0.1	0.05
SOC_I_3	0.3	−0.01	0.01	0.04	0.01	0.3	−0.3	−0.1	−0.1	0.01	0	0.06	0.09	0.1	0.14	0.15
SOC_I_4	0.6	−0.01	−0.3	−0.2	0	0.01	0.02	0	−0.1	−0.1	−0.1	0.04	0.01	−0.1	−0.05	−0
SOC_I_5	0.4	−0.01	0.01	0.02	−0.01	0	−0.3	0.1	0.03	−0.5	0	0.01	0.02	0.04	0.05	0.06
SOC_I_6	7.1	−0.1	0.2	−0.3	−0.4	0	0.1	0.4	−0.4	−0.8	−0.7	−0.3	−0.2	−0.1	0	0.1
SOC_I_7	29	1	−1	−2	2	3	4	1	2	−1	−3	−1.5	0	1	2	1
SOC_I_8	0.2	−0.02	0.03	0.04	0.01	0	−0.1	0.03	−0	0.01	0.05	0.01	0	0.03	0.07	0.01
SOC_I_9	21	−1	1	2	3	−3	−2	−3	−0.5	−2	−1	0	1	−2	−1.5	0
SOC_I_{10}	0.4	−0.04	0.01	−0.2	−0.03	−0.1	0	−0	−0	−0.6	−0.1	−0.1	−0.8	−0	−0.02	−0
SOC_I_{11}	0.3	−0.01	0	0.02	0.01	0.06	0.05	0.02	0.01	0.02	0	27.7	−0.2	0	0.01	0.02
SOC_I_{12}	22	−2	3	5	2	1	0	1	0	−2.5	−3.6	1.2	2	3.1	6.2	7.3
SOC_I_{13}	43	−1	−1	0	1	2	4	−1	−2	0	−4	−5	−2	−2.5	−5	−6
SOC_I_{14}	11	−12	−11	−10	−10	−9	−11	−12	−7	−8	−10	−11	−11	−9	−7.5	−7
SOC_I_{15}	3.3	−0.3	0.2	0.1	0	0.3	0.4	0.5	0.2	0	0.1	0.3	0.1	0.4	0.6	0.3
SOC_I_{16}	34	−2	−1	1	2	3	4	3	2	1.6	−1.7	−1.6	−1.7	−1	0	1
SOC_I_{17}	4.3	−0.3	0.2	0	−0.1	0.2	0.1	0	−0.2	0.4	0.2	0.5	0.6	0.4	−0.1	0.1
SOC_I_{18}	3 .3	−0.1	−0.3	−0.2	0	0.2	0	0.3	0.1	0.4	0.4	0.5	0.1	0	0.1	−0.1
SOC_I_{19}	5.2	−0.2	−0.1	0	0.1	0	0.3	0.2	0.4	0.1	−0.1	0.5	0	0.3	−0.1	0.1
SOC_I_{20}	3.5	−0.5	−0.1	0	−0.2	−0.4	0.2	0.3	−0.1	−0.2	0.2	0.1	−0.2	−0.3	−0.4	−0.2
SOC_I_{21}	315	−150	−50	150	−120	50	−30	170	150	350	250	450	550	−50	50	150
SOC_I_{22}	1.5	−0.7	−0.2	0.3	−1.2	−0.4	−0.1	0	0.1	0.2	0	0.1	0.1	−0.3	−0.2	−0.5
SOC_I_{23}	0.3	−0.02	−0.1	−0.2	−0.02	−0.1	−0.1	−0	−0	−0.2	−0	−0	−.2	−0	−0.02	−0

(continued)

Table 6 (continued)

	Businesses														
$SOC\_I_i^c$	Trh	Years													
		B_1^b					B_2					B_3				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
SOC_I_{24}	4.6	−0.6	−0.1	0	0.1	0.2	−0.3	−0.4	−0.1	−0.3	0.1	−0.1	−0.4	0	0.1	−0.4
SOC_I_{25}	1.3	−1.5	−1	−0.5	0.5	−2.5	−0.5	2.5	1.5	0.5	−1.5	−0.5	0	−0.5	3.5	0.5

[a]In according to Eq. 5

[b]Businesses 1, 2 and 3

[c]Social indicators which are described in appendix B

Table 7 Final score of social indicators[a]

	Businesses															
SOC_I	WF	Years														
		B_1[b]					B_2					B_3				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
SOC_I_1	0.08	0.011	0.015	0.006	0.009	0	0.004	0.01	0.013	0.018	0.012	0.011	0.010	0.005	0.08	0.011
SOC_I_2	0.01	0.016	0.010	0.008	0.018	0.017	0.009	0.017	0	0.002	0.004	0.008	0.009	0.017	0.021	0.016
SOC_I_3	0.04	−0.06	−0.04	−0.01	−0.04	−0.02	−0.08	−0.04	−0.04	−0.07	−0.05	−0.09	−0.06	−0.05	0.04	−0.6
SOC_I_4	0.07	0.019	0.016	0.018	0.021	0.022	0.024	0.021	0	0.003	0.007	0.027	0.022	0.009	0.07	0.019
SOC_I_5	0.04	0.008	0.013	0.015	0.008	0.011	0.004	0.013	0.017	0	0.011	0.013	0.015	0.019	0.04	0.008
SOC_I_6	0.01	0.012	0.017	0.008	0.007	0.014	0.015	0.021	0.007	0	0.001	0.008	0.010	0.012	0.01	0.012
SOC_I_7	0.01	−0.002	0.021	0.033	−0.014	−0.026	−0.08	−0.02	−0.00	0.012	.045	0.027	0.009	−.,02	0.01	−0.02
SOC_I_8	0.08	0	0.010	0.012	0.006	0.004	0.002	0.010	0.002	0.006	0.014	0.006	0.004	0.010	0.08	0
SOC_I_9	0.05	0.005	0.010	0.012	0.015	0	0.002	0	0.006	0.002	0.005	0.007	0.010	0.002	0.015	0.005
SOC_I_{10}	0.01	0.002	0.004	0.003	0.002	0.003	0.004	0.003	0.003	0.001	0.001	0.005	0	0.002	0.01	0.002
SOC_I_{11}	0.08	6.56	1.31	2.62	1.97	5.25	4.59	2.62	1.97	2.62	1.31	0.018	0	1.31	0.08	6.56
SOC_I_{12}	0.01	0.003	0.012	0.016	0.010	0.008	0.007	0.008	0.007	0.002	0	0.009	0.010	0.013	0.01	0.003
SOC_I_{13}	0.04	0.012	0.012	0.014	0.016	0.019	0.024	0.012	0.009	0.014	0.004	0.002	0.009	0.008	0.04	0.012
SOC_I_{14}	0.01	0	0.004	0.008	0.008	0.012	0.004	0.002	0.021	0.016	0.008	0.006	0.004	0.012	0.01	0
SOC_I_{15}	0.021	0.006	0.007	0.007	0.007	0.008	0.008	0.008	0.007	0.007	0.107	0.008	0.007	0.008	0.01	0.006
SOC_I_{16}	0.08	0	0.003	0.009	0.012	0.015	0.018	0.015	0.012	0.010	0.000	0.001	0.009	0.003	0.08	0
SOC_I_{17}	0.05	0	0.008	0.005	0.003	0.008	0.006	0.005	0.001	0.011	0.008	0.013	0.015	0.011	0.05	0
SOC_I_{18}	0.08	0.004	0	0.002	0.006	0.011	0.006	0.013	0.009	0.015	0.015	0.018	0.009	0.006	0.08	0.004
SOC_I_{19}	0.021	0	0.003	0.006	0.009	0.006	0.015	0.012	0.018	0.009	0.003	0.021	0.006	0.015	0.01	0
SOC_I_{20}	0.04	0	0.012	0.015	0.009	0.003	0.021	0.024	0.012	0.009	0.021	0.018	0.009	0.006	0.04	0
SOC_I_{21}	0.024	0	0.004	0.013	0.001	0.008	0.005	0.014	0.013	0.022	0.017	0.026	0.030	0.004	0.04	0

(continued)

Table 7 (continued)

	Businesses														
SOC_I	WF	Years														
		B_1^b					B_2					B_3				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
SOC_I_{22}	0.027	0.009	0.018	0.027	0	0.014	0.02	0.021	0.023	0.025	0.021	0.023	0.023	0.016	0.07	0.009
SOC_I_{23}	0.07	0.015	0.017	0.011	0.007	0.023	0.019	0.027	0.023	0.011	0.007	0.016	0.011	0.015	0.07	0.015
SOC_I_{24}	0.024	0	0.015	0.018	0.021	0.024	0.009	0.006	0.015	0.009	0.021	0.015	0.006	0.018	0.04	0
SOC_I_{25}	0.01	0.003	0.005	0.007	0.016	0	0.007	0.01	0.014	0.010	0.003	0.007	0.008	0.007	0.01	0.003
Total		**0.11**	**0.23**	**0.27**	**0.18**	**0.20**	**0.19**	**0.27**	**0.21**	**0.21**	**0.23**	**0.31**	**0.249**	**0.23**	**0.58**	**0.276**

[a]In according to Eq. 5
[b]Businesses 1, 2 and 3

Table 8 Final composite businesses sustainability score

Year	SBS_I		
	B_1	B_2	B_3
1	0.11	0.43	0.50
2	0.36	0.40	0.43
3	0.45	0.42	0.41
4	0.41	0.40	0.74
5	0.39	0.45	0.47

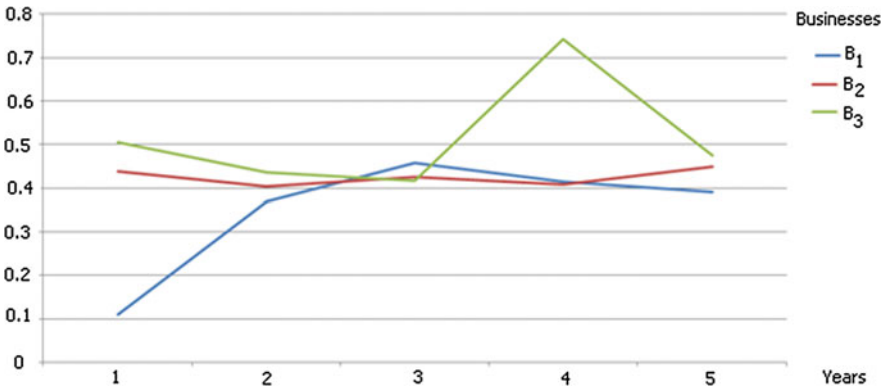

Fig. 2 Comparative analysis among SBS of the sampled businesses

social indicators have a significant contribution on the composite corporate sustainability index.

Table 7 shows the final scores of corporate social indicators. They are estimated as a product between weight factors and normalized social scores. The significance of these indicators is ranged from 20 to 30%.

Finally, Table 8 estimates composite sustainability score as the sum of three sub-indicators such as economic, environmental, and social indicator.

Finally, Fig. 2 shows a comparative analysis for three businesses. Particularly, it is showed the evolution for their composite business sustainability performance indexes. It is identified that the second business presents a constant increasing, while the first business achieves initially a short growth and afterwards a sharply decrease of total sustainability performance.

5 Final Remarks

This book chapter suggests a methodology to measure business contribution to strong sustainability. It focuses on developing a composite business sustainability index. The first innovation of the proposed methodology is the new indicators

which combine the performance of businesses with specific thresholds. This could offer a clear signal to stakeholders regarding the contribution of businesses to strong sustainability. The second innovation is the clarification of each aspect of sustainability in an operational manner.

Starting from the financial aspect, it has been made an effort to integrate some of the considerable knowledge of sustainability into financial indicators such as long-run viability and equity among generations. A significant contribution to the debate of financial sustainability is the idea of efficiency behind the financial indicators which assist in overcoming recent analysis for economic sustainability only as profit maximization. This seems to be unable to explain temporary losses in financial statements. Furthermore, the worry for persistent progress of profits cannot promise continual business sustainability due to the fact that sustainability is a complex problem with many different variables. Continues growth for profits is a permanent request of shareholders who endeavors to increase their earnings per share in a daily basis.

The proposed framework contributes also by developing specific thresholds for each aspect of sustainability. They assist in estimating the proper level of participation of businesses to the overall strong sustainability performance. This assists in overcoming the request of current measurement techniques which propose only the continual improvement of each aspect without taking into account the certain goals of sustainability such as safe minimum standards and protection of carrying capacity of ecosystems. The contribution to this debate is made by suggesting environmental thresholds which are necessary to be associated with views such as carrying capacity, safe minimum standards, and critical capital.

Finally, the case study provides practical implications of the proposed methodology for scholars and stakeholders. The diagrammatically representations of corporate sustainability performance provide an easy instrument to make comparative analysis of business sustainability. The suggested methodological framework contributes to food industry literature by integrating the concept of strong sustainability into the overall debate of food industry sustainability. So far, two interesting academic debates are in this field such as Corporate Social Responsibility of food industry and sustainability of supply chain of food industry. The former debate emphasizes on examining the responsibilities of food industry against the health of consumers by analyzing many practices which are adopted or should be adopted by food industry (e.g., production of healthy and low-fat products as well as awareness of consumers regarding products' potential negative impacts). Food industry adopts CSR and sustainability practices to address the community's criticism regarding food production, distribution, and pricing. The latter debate focuses on examining sustainability in food supply chain and mainly the impacts of product distribution to sustainable development (e.g., energy and water consumption). A higher emphasis has been put on waste management of food industry in order to protect natural resources and guarantee food for future societies.

However, the suggested framework comes to contributes to these debates by doing more operational and quantifiable the concept of sustainability and mainly in the field of food manufacturing. It also contributes with thresholds which are

associated with carrying capacity and capabilities of an area. The majority of previous methodologies offer various indicators under an unsystematic manner which confuse stakeholders to understand their content and make a similar indicator. The proposed framework is based on GRI guidelines to overcome this significant problem.

Certainly, as any other study, it has some limitations which could be a good basis for future research. The first limitation is associated with the size of the sample. Only three businesses is a small sample which should be increased in the future. Many other studies could be conducted regarding food industry. The second limitation pertains to the calculation of thresholds which should be made more clearly and accurately by estimating all supply chains of food industry. It could be a good area for future research by combining many different academic fields.

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