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The influence of external factors on supply chain sustainability goals of the oil and gas industry

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ABSTRACT

This paper empirically explores the relationship between the external factors within the oil and gas (O&G) industry business environment and supply chain sustainability goals to understand the factors that could drive or hinder its adoption of sustainable supply chain management (SSCM) practices. It examines the relationships between six external factors (political stability, economic stability, stakeholder pressure, competition, energy transition and regulations) and sustainability goals through multiple regression analysis, using survey data from companies that operate in the O&G industry. Data analyses reveal that there are two types of sustainability goals namely strategic goals (SGO), which are conditional for long term survival, and functional goals (FGO), which are closely related to the companies' operational processes. The analyses also show that stakeholder pressure and economic stability are the most influential factors that could affect the goals. While competition within the O&G industry has a positive effect on the FGO, competition from the broader energy industry results in a negative effect on the SGO. The influence of energy transition relates to a higher focus on SGO. The results are useful in designing SSCM strategy that could help the O&G industry address the pressure from the external factors for more sustainable supply chain practices to achieve its sustainability goals.

1. Introduction

Concerns about the impacts of oil and gas (O&G) exploitation on the environment and society wellbeing have led to increasing pressures for the O&G industry to improve the sustainability of its supply chain. The industry's external business environment, however, can pose huge challenges to its implementation of sustainable supply chain management (SSCM) practices (Silvestre, 2015). This necessitates greater understanding of the factors within the environment ("external factors") that can affect the SSCM practices, which can ultimately help the O&G industry addresses the external pressures and achieve its sustainability goals.

SSCM is defined by Carter and Rogers (2008, p. 368) as "the strategic, transparent integration and achievement of key organization's social, environmental and economic goals in the systemic coordination of key business processes for improving the long-term economic performance of the individual companies and its supply chain". Lakhal et al. (2007) note that there is a lack of studies on sustainable supply chain in the O&G industry context. Existing studies are mostly focused on organizational micro-environment and operational issues related to the integration of sustainability in supply chain functions (see for example, Abdulrahman et al., 2015; Ngoasong, 2014; Tesfay, 2014; Yusuf et al., 2013). The macro business environment of the O&G industry supply chain hardly received any attention.

Carter and Rogers (2008) assert that sustainability in supply chains occurs when organizations incorporate explicit and comprehensive economic, environmental and social goals in the development of their strategic vision and long-term strategic objectives. Achievement of these goals can be influenced by internal and external environment factors. This underscores the need to identify the factors that can drive or hinder the achievement of the goals (Seuring and Müller, 2008b). Currently, sustainability goals are seldom explicitly incorporated in SSCM framework as a distinct factor that could influence strategy formulation or be affected by other factors within business and organizational environment (see for example in Hervani et al. (2005) and Pagell and Wu (2009)). The goals are instead often discussed in relation to the aim of designing and implementing SSCM solutions that can facilitate joint-optimization of economic, environmental and social

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performance (Beske, 2012; Harms et al., 2013; Paulraj, 2011). Furthermore, compared to internal factors, the existing SSCM literature offers no empirical evidence on how external factors could determine companies' supply chain sustainability goals.

The sustainability of the O&G industry supply chains is important to the achievement of sustainable future. Greater understanding on how the industry's external business environments can affect its SSCM practices is needed in order to facilitate our transition towards that future. This study, therefore, aims to address the knowledge gap in the area by exploring the relationship between external factors and supply chain sustainability goals. We argue that understanding the relationship is crucial because the sustainability goals that companies pursue will eventually determine the SSCM strategies that are adopted to achieve the goals and address sustainability pressures (Porter, 1991). We formulate the following research questions in order to achieve the aim of this study:

1. What are the factors in the O&G industry external business environment that could affect its SSCM practices?
2. What are the supply chain sustainability goals of the companies that operate in the O&G industry?
3. What are the relationships between the external factors and the supply chain sustainability goals?
4. How can the external factors affect companies' focus on the goals, thus their SSCM practices?

Insights gained from this study could help increase our understanding on how external factors can drive (or hinder) SSCM implementation in the O&G industry. It could also help companies in the industry to identify the internal capabilities and resources that must be developed to address the pressure from the factors and to achieve their sustainability goals. Generally, this study is part of a larger project that explores the contextual factors (i.e. external business-related factors and internal organizational-related factors) that could influence SSCM practices in the O&G industry. In this paper, we focus our discussion specifically on the relationship between external factors and supply chain sustainability goals.

This paper is organized as follows. Section 2 reviews the literature related to the external factors within the O&G industry business environment. In Section 3 we discuss the important sustainability issues in the O&G industry that help us determine the goals that must be studied. Section 4 describes the method used to determine the relationships between the external factors and supply chain sustainability goals. This is followed by Section 5, which discusses the results of data analysis. Section 6 concludes the study and presents its implications.

2. External factors of sustainable supply chain management

The external business environment of the O&G industry consists of dynamic factors that could threaten companies' ability to address sustainability pressures. They could also provide opportunities for business expansion, technological innovations and improvement in working practices.

This study adapted the PESTEL (political, economic, social, technological, environmental and legal) model to identify the external factors that could influence the O&G industry's supply chain sustainability goals. The model can be used to assess companies' operating environment and identify how it could affect their activities (Gillespie, 2011; Yüksel, 2012). Based on the PESTEL model as well as the O&G business environment and SSCM literature, we think that six external factors are especially relevant to this study namely: political stability, economic stability, stakeholder pressure, competition, energy transition and regulations.

We incorporate three factors from the PESTEL model, i.e. economic, political and legal, in this study. The environmental and social factors are not addressed separately because we consider the factors as intrinsic to the discussion of the external business environment. The technological factor, on the other hand, is addressed through competition between different types of energy companies and sources. We include stakeholder pressure in this study because it is one of the most important external pressures for SSCM practices (Seuring and Müller, 2008b). We consider energy transition as very relevant to the study of SSCM practices in the O&G industry because the factor could affect the sustainability strategy used to address climate change and energy security issues (Escobar and Vredenburg, 2011; Fouquet, 2010). We will discuss the external factors in the following order: political stability, economic stability, stakeholder pressure, competition, energy transition and regulations.

2.1. Political stability

The relationship between energy with politics is apparent in the event of crisis (Pascual and Zambetakis, 2008). According to Iankova and Katz (2003), there are two sources of political risks: (1) governmental sources related to official decisions and activities that could affect capital or profits, and (2) societal sources spur by public interest groups that could cause, unrest, civil war, industrial protest or boycotts. For example, government decisions and actions related to tax and fiscal policies, protection of foreign investment, administrative efficiency and transparency can affect companies' decision regarding their plant location (Bhatnagar and Sohal, 2005). Political instability can also threaten the security of O&G supply chain (Urciuoli et al., 2014). Conflicts resulted from the instability could lead to adverse events that can cause financial loses, ecological disasters, and affect employees and infrastructure safety (Al-Damkhi et al., 2009; Urciuoli et al., 2014). This creates uncertain business environment as supply chain is exposed to disruption risks caused by the instability (Abbasi and Nilsson, 2012; Kleindorfer and Saad, 2005). The unstable environment also increases the difficulty of conducting international O&G development cooperation (Correljé and van der Linde, 2006).

2.2. Economic stability

Economic slowdown will cause reduction in energy demand and price. As many producing countries rely on their O&G revenue to finance development projects and subsidies (Correljé and van der Linde, 2006; Doraisami, 2015; Wolf, 2009), lower revenue will affect governments' political will to incentivize sustainable energy projects and innovations (Pascual and Zambetakis, 2008). The slowdown will also affect companies' ability to maintain and invest in O&G development technology and infrastructure, as well as in restructuring initiatives towards low carbon energy system (Pascual and Zambetakis, 2008). For example, Ovadia (2016) find that oil companies will use less local goods/services to reduce operating cost during low oil prices. In order to address the needs to reduce spending and downsize operations, Olson (2010) suggests that a strategy based on scalable and variable-cost structure through strategic shared services and outsourcing practices could help the companies to minimize supply chain risks. Similarly, Jüttner and Maklan (2011) find that the risk of ripple effects of economic recession on supply chain can be mitigated through flexibility to shift to cost-effective supply sources and optimize capacity utilization, improvement in supply chain visibility through information sharing, and collaboration with supply chain partners.

2.3. Stakeholder pressure

Stakeholders are any persons or groups that may be benefited (harmed) by firm's actions (inactions), which may include governments, investors, suppliers, political groups, communities and competitors (Donaldson and Preston, 1995). According to Garcés-Ayerbe et al. (2012), companies will become more proactive toward environmental strategy when they perceive greater stakeholder pressure. Increasingly more companies in the O&G industry are involved in corporate social responsibility (CSR) practices to address stakeholder concerns (Frynas, 2005; Hilson, 2012). However, Frynas (2005) found that the impact is rather short lived and philanthropic in nature due to companies' failure to consider the involvement of CSR beneficiaries (such as local communities) in the program development. Mitchell et al. (1997) propose that stakeholder salience, which depends on the power that they hold, and the legitimacy and urgency of their claim, determines the degree to which managers prioritize competing stakeholder claims. Therefore, the level of company engagement with a stakeholder group could indicate their saliency, thus the actual pressure that they exert upon the company.

2.4. Competition

Competition can influence a company's SSCM strategy (Seuring and Müller, 2008a), and the O&G industry is a highly competitive business (Wagner and Armstrong, 2010). Almost 80% of the world's oil supply comes from just three areas namely Russia, the Persian Gulf and West Africa (Xu, 2008). This increases the competition to gain access to O&G reserves, especially between national O&G companies (NOCs) and international O&G companies (IOCs), where the majority of the reserves are controlled by the NOCs (Edwards et al., 2010; Kjärstad and Johnsson, 2009; Wolf, 2009). To address the competition, IOCs are putting more efforts on developing unconventional O&G sources such as from oil sands and shale gas. The unconventional O&G are more economically viable when oil price is high since greater risk control are needed to reduce their environmental, economic and strategic risks (Farrell and Brandt, 2006). Edwards et al. (2010) found that the emergence of alternative energy could also impact O&G companies' future competitiveness. In order to develop an advantage over competitors, Beske and Seuring (2014) stress that companies must focus their core values on improving the sustainability performance of their supply chains.

2.5. Energy transition

The dependency on oil has created technological lock-ins such as in energy and transport infrastructures. Therefore, government intervention are needed to ensure successful transition because progress in emerging energy technologies is difficult when left to be determined by market forces (Roy et al., 2013). The use of transitional support such as fiscal instruments could help in generating market forces, and provide incentives for new and existing energy players to pursue low carbon energy projects (Parthan et al., 2010; Roy et al., 2013). This fiscal instruments can be in the form of taxes, green certificates, subsidies and loans (Roy et al., 2013). Waisman et al. (2014) stress that the policy measures used should provide correct incentives for long-term investments and incorporate sectoral measures that complement pricing scheme measures. Although this would create an uneven playing field that favours low carbon energy, it could help spur the growth of sectors that face biased market behaviours. The response of the O&G industry to the transition is predicted to be unprecedented in the history of energy transition where they would become more competitive and harder to be replaced (Fouquet, 2010).

2.6. Regulations

The O&G industry activities are highly risky to the environment and society wellbeing. The Deepwater Horizon accident in 2010 illustrates the severity of O&G industrial accident. The accident has exposed the lack of regulatory pressure on safety, health and environment (SHE) protection, in this case, for offshore O&G operations (Lin-Hi and Blumberg, 2011). A study by Anejionu et al. (2015) also reveals that oil companies has exploited the lapses in Nigeria's petroleum laws to gain economic advantages that negatively affect local communities and environment. Studies have found that regulatory pressure can encourage the adoption of sustainable supply chain practices (Seuring and Müller, 2008a; Wu et al., 2012; Zhu et al., 2007a). However, the factor could also inhibit novel environmental practices by lowering their competitive value (Grekova et al., 2014). For example, most O&G companies operate in several countries and therefore, can be subjected to different regulatory requirements, which are often ambiguous and overlapping causing delays and cost increase (Harris and Khare, 2002; Wagner and Armstrong, 2010). Cross-functional integration in supply chain is needed to address these risks (Wu et al., 2012; Zhu et al., 2010; Zhu et al., 2005). For example, through purchasing practices that consider sustainability requirements of production and logistics functions as well as suppliers capabilities. The use of environmental management system to assess suppliers' environmental performance could also help reduce the risks (Darnall et al., 2008).

The complex business environment of the O&G industry, where many factors that are often beyond management control interact, could influence its ability to balance economic profitability with environmental and social responsibility. It is therefore important for companies in the industry to set clear supply chain sustainability goals to guide their supply chain management practices. This underscores the need to identify the factors that can drive or hinder the achievement of the goals for more effective implementation of SSCM strategies.

3. Sustainability goals of the O&G industry

According to Azzone and Noci (1998), the integration of sustainability into companies' activities can be achieved by linking sustainability goals and measures to corporate strategy. This indicates the importance of having clear sustainability goals to guide companies SSCM implementation. In order to create a sustainable supply chain, Pagell and Wu (2009) find that managers must integrate sustainability goals into the chain's day-to-day management. In addition, sustainability goals must be identified early in the design process of supply chain's performance management systems to facilitate the measurement and management of its activities (Hervani et al., 2005; Schaltegger and Burritt, 2014).

Currently, no studies have examined the sustainability goals of O&G supply chains. As goals may not be stated explicitly, we take a first step to gaining an understanding of the goals by identifying the O&G supply chain sustainability issues that are publicly reported by companies. We argue that these are valid leads to influence the companies' priorities and, eventually, their sustainability goals.

We referred to sustainability reports of O&G companies since many of them conduct a materiality study among their stakeholders to identify the important issues that should be addressed in the reports. According to GRI (2015), material topics are those that could (in)directly affect a company's ability to create, preserve or erode the triple bottom line (i.e. economic, environmental and social) value of the company itself and its stakeholders.

We examined the 2010 sustainability reports of 12 major

Table 1
Material sustainability issues to O&G companies and stakeholders.

Issues	Company											
	ADN	ENI	HES	KNO	MIT	ONG	OMV	PEM	PET	ROS	SAS	TNK
Community development	x	x	x	x	x	x	x	x	x	x		x
Environmental management	x	x	x	x	x	x	x			x		x
Occupational health & safety	x	x	x	x		x	x				x	x
Climate change			x	x	x	x	x	x			x	
Resource efficiency	x	x			x	x	x	x			x	
Transparency		x	x	x				x	x	x		x
Stakeholder involvement		x	x				x		x	x		x
Employee training & education	x	x	x			x				x		x
Suppliers/contractors management			x	x		x	x	x		x		
Air emissions	x	x					x		x			x
Energy security				x		x	x				x	
Product responsibility	x					x	x			x		
SHE management systems		x						x		x	x	
Energy transition						x	x		x			
Innovations	x			x					x			
Transport safety							x			x		x

Note: Abu Dhabi National Oil Companies (ADN), Eni (ENI), Hess Corporation (HES), Korean National Oil Corporation (KNO), Mitsubishi Corporation (MIT), Oil & Natural Gas Corporation (ONG), Petroleos Mexicanos (PEM), Petrobras (PET), Rosneft (ROS), Sasol (SAS) and TNK-BP (TNK).

companies in the O&G industry. Overall 97 issues were identified through the materiality study. Sixteen issues are identified as having the strongest replication across the 12 companies, which are summarized in Table 1. The most important issue is the impact of company activities on local community's social and economic wellbeing (i.e. community development). It is quite interesting to note that energy transition, specifically the development of alternative energy, is among the least important issues despite the growing political and public attention on the issue. Sustainability of logistics activities is hardly mentioned as important as well; logistics issue that is considered as material largely concerns about transport safety.

Further analysis of the important issues leads us to identify supply chain sustainability goals that should be investigated. In this study, we chose to focus on goals that could directly determine supply chain sustainability. Therefore, goals related to broader corporate social responsibility (CSR) initiatives namely training and education and community development are not included. The goals that we focus on are as follows:

1. Safety, health and environmental (SHE) management
2. Resource efficiency
3. Transparency of sustainability reporting
4. Guidance to stakeholders on company operations
5. Sustainability of supply management practices
6. Energy security
7. Product responsibility
8. Sustainability of logistics activities
9. Development of unconventional O&G
10. Development of alternative energy

Even though the development of unconventional O&G and alternative energy are not among the most important issues, they are included in this study due to the importance of these sources in the current debates about energy transition and energy security (Fouquet, 2010, Szklo and Schaeffer, 2006). The O&G industry's involvement in the development of these energy sources will require changes to their technological and infrastructure needs as well as their supply bases. It is therefore important to include them in the contextual study of SSCM practices in the industry.

In summary, the discussion above reveals the various sustainability issues that companies have to deal with. The existing literature provides little insights into the relationship between the external factors and sustainability goals of companies in the O&G industry. Empirical research can help address this gap and identify the factors that drive (or hinder) companies' focus on a particular sustainability goal.

4. Survey approach and sample

We conducted a survey among companies involved in O&G supply chain to test the relationship between the external factors and sustainability goals. The survey population was not restricted to a specific country or region because the study involves understanding supply chain contextual environment (i.e. the external factors) in a more fundamental sense. A broader population was necessary to gain this understanding. Companies that operate along different segments (upstream and downstream) of the O&G supply chain were chosen to ensure that all of the industry's subsectors are considered. We draw our sample from the Kompass database, using purposive random sampling, to select companies from the upstream and downstream segments.

We developed a questionnaire based on the literature review and sustainability reports of O&G companies discussed earlier. We consulted academic experts in the areas of the O&G supply chain, SCM and survey methodology to review and improve the questionnaire. The questionnaire was then pre-tested with experts from three O&G companies through personal interviews and emails. Further items were revised after the pre-test where 29 measurement items of the external factors (six questions, overall) and ten supply chain sustainability goals' measurement items (one question) were retained (please refer to Table 5 and Table 6 for the list of the items). We used a 6-point Likert scale (“not at all” to “very high”) to measure all items except for the items on the political variable, where we used a 5-point Likert scale (“never” to “very often”).[1]

4.1. Data collection

We employed both online and mail-based methods to send the questionnaire to senior managers of our sample companies.

[1] We standardized the two Likert scale so that both use similar 1–5 intervals.

Supply chain or sustainable development managers were chosen when the contact information are available on the companies' websites; otherwise the emails/letters were addressed to chief executive officer or managing director. We chose to send the questionnaire to senior managers to reduce the potential for one-respondent bias in the survey. We assumed that the senior managers have a good understanding of the companies' activities and are able to access the information needed to answer the questionnaire.

We sent out a large number of surveys with different rounds of follow-up, over a period of 6 months, to reach an acceptable response. Initial invitations for an online survey were e-mailed to 4300 companies. A mail-based survey followed among 800 companies. The first round yielded 71 responses, of which 60 were usable. The mail survey returned 36 questionnaires, 34 of which usable. Overall, there are 94 valid questionnaires out of 107 responses that we received. The response rate is low, but we think that this is a sufficient sample considering the difficulty of getting adequate responses in studies specific to the O&G supply chain (see for example, Andersen and Mostue (2012) and Yusuf et al. (2014)).

The profiles of the respondents of our survey are as shown in Table 2.

Table 2
Profile of respondents.

Criteria	Total	Percentage
Job title		
Chairman of the Board/President/Chief Executive Officer/ Managing Director	20	21.28
Executive Vice President/Chief Financial Officer/Chief Operating Officer	3	3.19
Vice President/ Director/General Manager	14	14.89
Manager	22	23.40
Others	13	13.83
Missing	22	23.40
Years working for company		
Less than 5	22	23.40
6–10	23	24.47
11–15	13	13.83
More than 16	22	23.40
Missing	14	14.90

Table 3 shows the characteristics of the companies that responded to our survey invitation.

Generally, five of the companies operate in both upstream and downstream supply chains. Fifteen companies, approximately 16% overall, that are involved in the upstream and/or downstream segment also serve as manufacturer, supplier or service provider. The majority of the sample operates in Europe (66%) and Asia (41%). About 31% are involved in the O&G development in the Middle East, 21% in North Africa and 32% in North America.

4.2. Data quality

Before proceeding with further analysis, we checked the data gathered for the potential of non-response bias. The analysis was done by comparing the responses from the first wave of the online and mail survey with the second wave of responses from both approaches, as suggested by Armstrong and Overton (1977). Specifically, the first two thirds of the responses from the online and mail survey are considered as the first wave, while the remaining responses are considered as the second wave. The difference in the responses between the two waves was analyzed using *t*-Test. The results shown in Table 4 indicate that there are no significant differences between the two waves of responses. Therefore, we can conclude that non-response bias should not be an issue in our survey.

We conducted an exploratory factor analysis to reduce data and also to derive groupings of items used to measure the external factors and supply chain sustainability goals. The factors were extracted using the principal component method, followed by a varimax rotation. Based on the results of the factor analysis we retained factors with eigenvalues that are greater than one, as suggested by Hair et al. (2010), because each factors must account for the variance of at least a single variable. For practical significance, factor loadings that are greater than ± 0.50 were also used as a threshold in the selection criteria (Hair et al., 2010).

The results of the factor analysis for external factors are shown in Table 5. The analysis revealed that there are eight external factors. One measurement item loaded on two different factors indicating that the item can represent different concepts, therefore cannot be distinguished (Hair et al., 2010). The item was deleted due to the cross-loading. We found that the political construct consists of two factors that can be distinguished as: (1) 'government-induced political stability' (PGO), and (2) 'society-induced political stability' (PSO). The competition construct also consists of two factors that we labelled as: (1) 'competition from within O&G industry' (COG), and (2) 'competition from broader energy

Table 3
Characteristics of sample.

Criteria	Total	Percentage
Business sector*		
Upstream (i.e. exploration and production)	37	39.36
Downstream (i.e. refining, petrochemicals, power producer)	29	30.85
Manufacturer/supplier/service provider	67	71.28
Missing	12	12.77
Number of employees		
Less than 1000	53	56.38
1001–5000	8	8.51
5001–10000	8	8.51
More than 10,000	12	12.77
Missing	13	13.83
Annual turnover		
Less than $250 million	44	46.81
$250–500 million	5	5.32
$501–750 million	2	2.13
$751–1 billion	4	4.26
More than $1 billion	25	26.60
Missing	14	14.89
Number of countries company operates in		
Less than 15	60	63.83
16–30	8	8.51
31–45	4	4.26
More than 45	9	9.57
Missing	13	13.83
Involvement in industry network*		
International Association of Oil & Gas producers (OGP)	13	13.83
The World Petroleum Council (WPC)	7	7.45
The World Energy Council (WEC)	5	5.32
International Petroleum Industry Environmental Conservation Association (IPIECA)	5	5.32
European Oil Company Organization for Environment, Health and Safety (CONCAWE)	3	3.19
International Association of Drilling Contractors	3	3.19
Global Reporting Initiative	2	2.13
Global Compact	2	2.13
American Petroleum Institute	2	2.13
Other networks	32	34.04
Missing	66	70.21

* The total percentage is more than 100% because a company may be involved in multiple O&G business sectors and industrial networks

Table 4
t-Test results for non-response bias.

	t-test for equality of means		
	t	df	Sig. (2-tailed)
Number of countries company operates in	1.082	77	0.283
Size	−1.709	77	0.092
Revenue	−1.145	76	0.256
Extent of activities in O&G supply chain	−0.383	78	0.702

industry' (CEN). We retained the eight external factors since the underlying factors of political stability and competition might lead to interesting findings regarding their relationship with sustainability goals.

Table 6 shows the results of a factor analysis for the measurement items of supply chain sustainability goals. We removed three of the initial items based on the analysis. Interestingly, two of the deleted items are the development of unconventional O&G and alternative energy, which are not among the material issues found in the companies' sustainability report. The deletion resulted in two factors of supply chain sustainability goals. We categorized the factors as 'strategic goals' (SGO) and 'functional goals' (FGO). The SGO items relate to goals that are conditional for long-term survival of a company, while the FGO items are closely related to the companies' operational processes in supply chain management. It is therefore quite interesting that our factor analysis is able to distinguish these two types of supply chain sustainability goals. We retained both of the factors for further analysis because each external factor may have a different relationship with the goals.

Overall, the eight external factors and two supply chain sustainability goal factors explain 75.59% and 74.08% of the inherent variation in their measurement items respectively.

The use of exploratory factor analysis allows us to check for the potential of common method bias using Harmon's single-factor test (Podsakoff and Organ, 1986). All of the extracted factors for the external factors and sustainability goals have eigenvalues that are greater than one. In addition, there is no single factor that account for the majority of the variance of the two constructs – the first extracted factor of the external factors and sustainability goals account for about 14.78% and 37.99% of overall variance, respectively. Therefore, the results show that common method variance is not an issue in our study.

Normality test was conducted on all items and variables. The results indicate the existence of various degree of normality, thus we assumed that the data are able to satisfy the assumption of normal distribution. In addition, we also conducted a reliability analysis on all of the factors. As shown in Table 7, the Cronbach's alpha value of all factors are above 0.70, which satisfy the limit accepted to ensure constructs' internal consistency (Flynn et al., 1990). Table 7 also shows the results of a descriptive and correlation analysis. The analyses reveal that the correlations between independent variables are relatively weak or moderate, which could indicate low multicollinearity among the variables. This is important for the subsequent multiple regression analysis because high multicollinearity could reduce the variables' predictive power (Hair et al., 2010).

Table 6
Results of exploratory factor analysis for supply chain sustainability goals measurement items.

Variable	Measurement items	Factor loading
Strategic goals (SGO)	Provide guidance on company's operations to stakeholders (GUI)	0.84
	Transparency of sustainability performance reporting (TRA)	0.83
	SHE management (SHE)	0.77
	Energy security (ENS)	0.61
Functional goals (FGO)	Product responsibility (PRO)	0.86
	Sustainability of logistical activities (LOG)	0.86
	Sustainability of supply management practices (SUP)	0.81

Table 5
Results of exploratory factor analysis for external factors measurement items.

Variable	Measurement items	Factor loading
Government-induced political stability (PGO)	Uncertainty in government's energy policies	0.72
	Shifting economic priorities of government	0.63
Society-induced political stability (PSO)	Opposition to company activities due to social issues	0.85
	Political unrest	0.74
	Opposition to company activities due to environmental issues	0.61
Economic stability (ECO)	Investment in environmental protection programs	0.86
	Capital investment program	0.83
	Investment in social assistance programs	0.79
Stakeholders pressure (STH)	Education institutions	0.78
	Suppliers	0.77
	Governments	0.70
	Non-governmental organizations (NGOs)	0.68
	Competitors (i.e. other industry players)	0.68
	Local communities	0.67
	Shareholders	0.57
Competition within O&G industry (COG)	National O&G companies	0.86
	International O&G companies	0.86
	Unconventional O&G development	0.53
Competition within broader energy industry (CEN)	Alternative energy companies	0.78
	Companies other than O&G operators/producers	0.75
	Alternative energy development	0.69
Energy transition (ETR)	Transitional support to alternative energy as an ongoing subsidy to reduce carbon emissions	0.85
	Policy to encourage investment in energy efficiency to reduce O&G demand	0.82
	Policies that promote a level playing field for energy players	0.81
	Imposition of fiscal, taxation or other measures to promote low carbon/renewable energy	0.75
Regulations (REG)	Changes to compliance mechanism related to health, safety & environmental protection	0.82
	Cost related to compliance and remediation	0.79
	Regulations on materials use	0.69

Table 7
Results of descriptive, reliability and correlation analysis.

	Mean	SD	Cronbach's alpha	PGO	PSO	ECO	STH	COG	CEN	ETR	REG	FGO
PGO	3.39	1.11	0.86	1								
PSO	4.09	0.89	0.77	0.53***	1							
ECO	3.35	0.91	0.86	−0.25*	−0.23*	1						
STH	2.92	0.88	0.89	−0.47***	−0.40***	0.54***	1					
COG	2.55	0.98	0.77	−0.08	−0.25*	0.20+	0.30**	1				
CEN	2.23	0.85	0.75	−0.17	−0.15	0.17+	0.14	0.42***	1			
ETR	2.60	0.97	0.90	−0.39***	−0.35**	0.29**	0.43***	0.33**	0.49***	1		
REG	2.86	0.93	0.80	−0.28**	−0.46***	0.23*	0.36***	0.38***	0.24*	0.44***	1	
SGO	3.61	0.85	0.84	−0.29**	−0.27**	0.60***	0.75**	0.23*	0.05	0.38***	0.25*	1
FGO	3.70	0.82	0.88	−0.17	−0.17+	0.36***	0.54***	0.24*	0.06	0.25*	0.16	0.63***

$^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

5. Analysis and discussion

We conducted regression analysis to examine the relationship between external factors and supply chain sustainability goals. Three control variables were used to test the regression model namely company size, revenue, and the extent of company involvement along the O&G supply chain. We include the control variables to account for the possibility that these factors may influence the extent of companies focus on the goals. We organized the regression models into three sets, as follows:

1. For the first set, we test the relationship between the external factors and SGO; followed by the inclusion of the control variables (Table 8).
2. Similarly, the second set consists of the regression models between the external factors, FGO and the control variables (Table 9).
3. In the third set, we test the relationship between the external factors and the individual sustainability goals that measure SGO and FGO. The remaining regression models in Table 10 and Table 11 show the results of the analysis without and with the control variables, respectively.

Before proceeding, we examined the variance inflation factor (VIF) of all the models to determine the potential for multicollinearity. The largest VIF score in all of the models is 2.95, well below the maximum level of 10.0 suggested by Mason and Perreault (1991). This further indicates that multicollinearity should not be a problem with our data. We discuss the results of the regression analyses in the following sections.

5.1. Relationship between external factors and strategic sustainability goals (SGO)

Table 8 shows the results of the regression analyses for SGO. The models are highly significant with 61% of the variation in companies' focus on the strategic goals are explained by the external factors; about 69% to 70% when control variables are included in the analysis.

Generally, we find that 'economic stability' (ECO) has a highly, statistically significant, positive effect on the SGO in all models. According to Nuhu et al. (2014), economic stability can influence O&G revenue and companies' investment behaviour. Since environmental and social initiatives can be costly (Carter and Rogers, 2008), stable economic conditions allow the companies to invest in sustainability initiatives, which would otherwise be prioritized to maintain profit-making activities and infrastructures. We also find that 'stakeholder pressure' (STH) has a highly significant positive relationship with strategic goals. The factor has the largest coefficient in all models indicating that it is the most important factor that can affect the O&G industry's strategic sustainability goals. This is consistent with Seuring and Müller (2008b) finding that stakeholder pressure is an important driver of SSCM practices.

Table 8
Results of regression analyses for strategic goals (SGO).

Variables	Strategic goals (SGO)				
	Model 1	Model 2	Model 3	Model 4	Model 5
PGO	0.08	0.00	0.02	0.02	0.02
PSO	0.01	0.08	0.05	0.08	0.09
ECO	0.29***	0.31***	0.30***	0.35***	0.33***
STH	0.59***	0.59***	0.59***	0.57***	0.57***
COG	0.03	0.09	0.08	0.07	0.07
CEN	−0.15+	−0.12	−0.13	−0.14+	−0.14+
ETR	0.16+	0.06	0.07	0.07	0.08
REG	−0.05	0.05	0.04	0.05	0.06
Control variables					
Size		0.07			0.06
Revenue			0.05		0.00
Extent of activities in SC				0.07	0.07
Regression results					
F	18.84***	21.31***	20.83***	21.68	16.99***
R^2	0.64	0.73	0.73	0.73	0.73
Adjusted R^2	0.61	0.70	0.70	0.70	0.69

$^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

Although the relationship is weak, our analysis reveals that 'Energy transition' (ETR) has a significant positive effect on the SGO (see Model 1). This indicates that when there are more policy supports for alternative energy development, companies in the O&G industry will increase their focus on the strategic sustainability goals. However, the increased focus may not be induced by the competition from the broader energy industry (e.g. alternative energy companies/sources), as shown by the significant, albeit weak, negative relationship between CEN and the SGO. The advancements in the alternative energy development are relatively slow (Verbruggen et al., 2010). Thus, companies in the O&G industry might have little 'sense of urgency' to compete with the alternative energy in sustainability areas. Instead, the increase in focus on strategic sustainability goals may be motivated by the needs to enhance companies legitimacy as responsible corporate citizens during the transition to sustainable energy systems.

Another reason for these findings may be related to companies' involvement in alternative energy development to benefit from the fiscal and institutional supports given to alternative sources. Tax exemptions and subsidies for the alternatives may provide the incentives for the O&G industry to build their expertise in the alternative energy development (Roy et al., 2013). Since low carbon or renewable energy sources are more sustainable than O&G,

companies may be more inclined to disclose their involvement to offset the negative impact associated with O&G. Alternative energy development may also require changes in the existing management practices and infrastructures since different energy sources may have different development needs and risks. Therefore, the companies in the O&G industry can be expected to increase their focus on improving the strategic aspects of supply chain sustainability, such as through SHE systems or information transparency, to improve energy security.

The negative effect of CEN on the SGO could suggest that companies in the O&G industry do not compete with alternative energy by increasing their focus on the supply chain sustainability, but by focusing on the commercial/economic areas. Fouquet (2010) anticipates that the O&G industry would respond to the increased competition from the alternative energy by being more competitive and by making O&G sources harder to be replaced. For example, the industry can increase O&G supply, thus making them cheaper and quite effectively reducing the feasibility of alternative energy development and its advantages. This could, however, results in trade-off between economic goals with environmental and social goals in competitive energy market as O&G companies may lessen their focus on the environmental control to stimulate more O&G production. Unless there are strong financial or moral incentives for the companies to develop alternative energy and for consumers to use them, the advantages of the alternatives over O&G sources are rather weak when O&G prices are low. The suggestion made by Fouquet (2010) and the positive effect of CEN on energy security (ENS), although not statistically significant, could partly support these reasonings (see Tables 10 and 11).

5.2. Relationship between external factors and functional sustainability goals (FGO)

Table 9 shows the results of regression analyses for FGO. All of the models are highly significant, where about 26% to 40% of the variations in the focus on the functional goals are explained by the external factors and the control variables. Similar to the results of the SGO discussed earlier, we find that STH has the strongest positive relationship with the FGO. This indicates that companies in the O&G industry will focus on the sustainability of supply chain functions when they experience greater stakeholder pressures.

Table 9
Results of regression analyses for functional goals (FGO).

Variables	Functional goals (FGO)				
	Model 1	Model 2	Model 3	Model 4	Model 5
PGO	0.08	0.03	0.01	0.03	0.03
PSO	0.01	0.00	0.06	0.07	0.09
ECO	0.10	0.19^{+}	0.29*	0.12	0.33*
STH	0.51***	0.52***	0.49***	0.52***	0.44***
COG	0.12	0.19^{+}	0.21^{+}	0.18	0.19^{+}
CEN	−0.08	−0.07	−0.07	−0.06	−0.09
ETR	0.07	0.03	0.05	−0.01	0.07
REG	−0.07	−0.02	0.02	0.03	0.03
Control variables					
Size		−0.24*			−0.06
Revenue			−0.33**		−0.31*
Extent of activities in SC				0.03	0.12
Regression results					
F	5.03***	6.22***	6.90***	5.30***	5.73***
R^2	0.32	0.44	0.47	0.40	0.48
Adjusted R^2	0.26	0.37	0.40	0.32	0.40

$^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

Unlike strategic goals, the effect of ECO on the functional goals only becomes statistically significant when revenue is included in the analyses, see Model 3 and Model 5; the control variable has a negative relationship with the FGO. This indicates that stable economic conditions encourage companies to improve the sustainability of supply chain functional areas, but this is more likely among companies with lower revenue. A decline in revenue may force companies to implement selective investment measures to reduce operating costs and ensure financial efficiency. This can be challenging when the companies are also pressured to improve the sustainability of their activities, which may require additional investments.

Seuring and Müller (2008b) note that the cost of green initiatives can hinder the adoption of SSCM practices. A strategy that focuses on streamlining and creating synergies with supply chain partners could help companies address this problem and minimize supply chain risks (Jüttner and Maklan, 2011; Olson, 2010). For example, Zhu et al. (2007b) find that cooperation with suppliers in eco-design programs can improve supply chain efficiency and reduce costs. Tesfay (2014) suggests similar results can be obtained when O&G companies work closely with service providers to improve the environmental performance of their logistics activities. In addition, a study by Yusuf et al. (2013) reveals that companies in the UK O&G industry are able to reduce production cost, for example, through initiatives that encourage business meetings via teleconference, the use of energy saving devices and recycling programs. Our finding suggests that companies with lower revenue will exploit stable economic conditions to strategically reconfigure their supply chain strategies and utilize available resources more effectively to improve their performance.

We find that company size also has a significant negative effect on FGO implying that smaller companies can be expected to focus more on supply chain functional goals. Existing studies suggest that larger companies are more likely to adopt sustainable practices (Pagell et al., 2004; Zhu et al., 2008). However, small companies can benefit from their strategic characteristics such as shorter lines of communication and flexibility of managing external relationship (Aragón-Correa et al., 2008). As smaller companies may have fewer suppliers or products, this allows them greater flexibility to integrate sustainable practices in supply chain management. The advantage afforded by their size is especially important in competitive market. This is clearly shown in Model 2 where competition within the O&G industry affects the FGO positively, but smaller companies are more likely to increase their focus on the goals.

It is interesting to note the differences in the influence of the two types of competitions, COG and CEN, on the strategic and functional goals. Generally, COG has a significant positive effect on the FGO (when control variables are included, see Model 2, 3 and 5 in Table 9), but no effect on the SGO. As discussed earlier, the opposite is found for the effect of competition from CEN on the goals – competition from the broader energy industry has a significant negative effect on the SGO, but no effect on the FGO. Although the relationships are rather weak, it shows that companies' responses to different sources of competitions vary depending on its context.

The positive relationship between COG and FGO indicates that a higher focus on improving the sustainability of supply chain functions can help companies in the O&G industry to address competition from their industry peers. Hussain et al. (2006) note that major challenges in the management of O&G supply chain include the inflexibility of its logistics network, high transportation and inventory costs, and high variability of transportation time. In addition, since a large number of companies are involved in O&G supply chain, an operator may be served by suppliers/contractors with inadequate environmental or health and safety

sustainability initiatives (Midttun et al., 2007). The growing interest on unconventional O&G development also requires greater supply chain risk control due to the higher environmental, financial and strategic risks involved (Farrell and Brandt, 2006).

Shuen et al. (2014) identify several capabilities that companies must build in order to create sustainable value and remain competitive in the O&G industry. This includes: (1) organizational agility in suppliers/contractors selection and management; (2) collaborative approach to projects to benefit from sharing of resources, assets and expertise; (3) ability to learn, adapt and reconfigure assets and core capabilities to exploit new opportunities; and (4) ability to manage health, safety, security and environmental impact of operations effectively. This is rather consistent with Yusuf et al. (2014) finding that an agile supply chain can improve the competitiveness and performance of companies in the O&G industry. Therefore, companies that possess these capabilities will be able to differentiate themselves and gain competitive advantage in the industry, especially when they are able to incorporate sustainability aspects in their supply chain practices.

5.3. The relationship between external factors and each supply chain sustainability goal

The results of the regression analyses for each sustainability goal without control variables are shown in Table 10. Among the goals, 'transparency of sustainability performance reporting' (TRA) has the highest explained variance of 53%, followed by 'providing guidance to stakeholders with regard to company operations' (GUI), which is 48%.

Generally, STH has the most significant positive relationship with and the largest effect on all goals. ECO has a significant positive effect on three strategic goals: 'safety, health and environmental management' (SHE), GUI and TRA, but no effect on ENS. In addition, we find that CEN has a significant negative relationship with SHE. This further validates our earlier suggestion that greater competition from alternative energy players/sources can reduce companies' focus on sustainable supply chain practices.

We also find that REG has a significant, albeit weak, negative relationship with ENS; an increase in regulatory pressures will threaten companies' focus on ensuring security of energy supply. According to Wagner and Armstrong (2010), companies in the O&G industry have to deal with considerable regulatory and compliance risks. The cost of compliance varies widely and especially financially draining for smaller companies (Harris and Khare, 2002). Higher regulatory pressures increase the regulatory, financial and reputational risks that companies have to deal with (Wagner and Armstrong, 2010). Changes in the requirements or introduction of new policies could affect their ability to operate smoothly, for example due to the need to stop production activities until requirements are met, which could threaten their focus on energy security. In addition, companies might be discouraged to pursue innovative energy technologies to improve energy security due to the increase in regulatory requirements. This is in line with Grekova et al. (2014) finding that regulatory pressure has the potential to hamper the development of novel environmental technologies. Ford et al. (2014) suggest that companies in the O&G industry can collaborate with their supply chain partners to find innovative solutions to address increased regulatory pressures.

Table 11 shows the results of regression analyses with control variables. The results reveal that the relationship between ECO and 'sustainability of logistical activities' (LOG) becomes significant with the inclusion of the control variables. In addition, we find that PSO has a significant positive relationship with SHE – the only significant effect of the political stability factor among all of the models in this study. The analysis shows that the companies in the O&G industry will focus more on SHE management when they operate in stable political environment (i.e. less political-related disruptions from societal sources due to unrest or oppositions to their operations). The positive relationship between PSO and SHE could indicate that companies' characteristics could play a role in how they address the political pressure from societal sources. However, we are not able to identify which of the control variable can affect the relationship because none of them is statistically significant.

Similarly, an increase in REG results in higher focus on SHE. According to Wagner and Armstrong (2010), leading companies in the O&G industry conduct environmental, social and health impact assessments (ESHIA). The assessment is considered as a minimum acceptable standard of good practice for environmental and social risk management to address regulatory pressure, and to minimize the risk of non-compliance for all major new projects. Zhu et al. (2007b) observed a somewhat similar finding; higher regulatory pressures by government lead to greater level of GSCM practices among chemical/petroleum companies.

ECO and COG have a highly significant positive effect on 'sustainability of supply management practices' (SUP) when all control variables are included in the model. This indicates that companies would focus more on improving SUP practices in a competitive O&G industry environment when the economic condition is stable. However, the focus can be expected to be higher among companies with lower revenue, which is consistent with our earlier

Table 10
Results of regression analyses of each goal.

Variables	Strategic sustainability goals				Functional sustainability goals		
	SHE	GUI	TRA	ENS	SUP	LOG	PRO
PGO	0.00	0.15	0.09	0.04	0.06	0.11	0.07
PSO	0.15	−0.12	0.00	−0.01	0.01	0.03	0.00
ECO	0.23*	0.37***	0.28***	0.10	0.16	0.05	0.05
STH	0.28*	0.39***	0.55***	0.68***	0.49***	0.58***	0.31*
COG	0.10	0.08	0.06	−0.10	0.18+	0.04	0.10
CEN	−0.26*	−0.13	−0.13	0.01	−0.08	−0.07	−0.08
ETR	0.19	0.15	0.15	0.06	0.04	0.05	0.10
REG	0.13	−0.02	−0.06	−0.18+	−0.12	−0.04	−0.03
Regression results							
F	4.85***	11.85***	14.07***	9.39***	6.20***	5.07***	1.77+
R^2	0.31	0.53	0.57	0.47	0.37	0.32	0.14
Adjusted R^2	0.25	0.48	0.53	0.42	0.31	0.26	0.06

+$p < 0.10$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table 11
Results of regression analyses of each goal with control variables.

Variables	Strategic sustainability goals				Functional sustainability goals		
	SHE	GUI	TRA	ENS	SUP	LOG	PRO
PGO	−0.09	0.06	0.05	0.04	0.02	0.04	0.01
PSO	0.27*	−0.10	0.07	0.07	0.11	0.05	0.07
ECO	0.15	0.43***	0.33**	0.18	0.40***	0.26+	0.24
STH	0.30*	0.40***	0.51***	0.62***	0.43***	0.53***	0.27+
COG	0.12	0.14	0.07	−0.07	0.26**	0.12	0.14
CEN	−0.27*	−0.11	−0.10	0.00	−0.06	−0.07	−0.12
ETR	0.05	0.04	0.09	0.06	0.03	0.06	0.10
REG	0.24*	0.09	0.05	−0.14	−0.03	0.00	0.10
Control variables							
Size	0.19	0.05	0.04	−0.05	−0.03	−0.12	0.01
Revenue	0.05	−0.06	−0.02	0.01	−0.30*	−0.23	−0.29
Extent of activities in SC	0.03	−0.03	0.06	0.25	0.16	0.06	0.11
Regression results							
F	4.55***	12.98***	10.32***	6.52***	7.50***	5.13***	2.09*
R^2	0.42	0.68	0.63	0.51	0.55	0.45	0.25
Adjusted R^2	0.33	0.63	0.57	0.43	0.48	0.37	0.13

$^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

suggestion. This could be attributed to the greater need for these companies to have better SUP, such as more efficient and flexible sourcing practices and contract management that could help in cost and waste reduction. The O&G product mix is static where the products are also traded among companies in the industry. Therefore, very little product variation could differentiate them. Furthermore, companies that control O&G reserves will have more power in selecting their alliance (Edwards et al., 2010). A more sustainable SUP could help a company gain competitive advantage in the market, thus providing better opportunities for it to be awarded a contract in an O&G development project.

Another reason why greater focus on SUP is needed relates to the implementation of local contents strategy. O&G companies are often required by governments to incorporate local goods and services as part of O&G project licensing agreement. Local suppliers might lack the necessary capabilities to meet, for example, high environmental standards required in the O&G industry, which could be detrimental to supply chain sustainability performance (Hall et al., 2012). Therefore, more focus on SUP is necessary in this condition. Increased focus on sustainable supply chain practices will help companies to differentiate themselves (Beske and Seuring, 2014). This can help companies to secure their competitive position in the industry, which is especially important in a time when they are facing greater pressure to operate sustainably.

6. Implications and recommendations

This study seeks to understand the relationship between external business environment factors and supply chain sustainability goals of companies in the O&G industry. Several implications can be drawn from our findings.

First, our analyses reveal that stakeholder pressure has the largest effect on the strategic and functional supply chain sustainability goals. Companies have to deal with various stakeholder groups and claims, which can often be in conflict with their business interest and resource availability. In order to address this problem, the companies could employ proactive stakeholder engagement strategies by identifying the relevant stakeholder groups that could affect or be affected by their supply chain decisions and operations early on in a project. This process would allow the companies to identify the stakeholders' expectations and concerns, thus determine appropriate actions that can be taken to address them. It would also help the companies to develop an SSCM strategy that incorporate these aspects, thus minimizing the potential risks from grievances resulting from inefficient handling of stakeholder relations and expectations.

Second, we find an interesting observation related to the positive effect of energy transition and the negative effect of competition within the broader energy industry on the strategic supply chain sustainability goals. These findings are especially relevant to managers and policy makers regarding the role of the O&G industry during energy transition. Although O&G might remain as the major energy sources for decades to come, over time, we think the view that O&G and their alternatives are competing must change into one of complementarity. Stronger institutional pressures and incentives to promote collaboration between energy players are necessary to spur the energy transition and to facilitate the development of more sustainable energy solutions and technologies.

Third, we think we think that managers must carefully monitor the progress of alternative energy to identify viable business opportunities as well as advances in energy technologies that can be integrated into their existing infrastructure and capabilities. While it may seem to be financially advantageous to address the competition on a commercial basis, the O&G industry cannot really afford to ignore the competition for long, as demonstrated by the recent climate and carbon emissions agreements reached at the recent 2015 United National Climate Change Conference (COP21). Companies in the industry must integrate sustainable energy technologies in their supply chain management in order to address the sustainability pressures. It will also help the companies to remain relevant in a low carbon energy future. For example, the involvement of O&G companies in the development of alternative energy can help green their supply chains and facilitate their transition towards low carbon energy systems. Alternative energy sources like biomass, on the other hand, could benefit from the technological learning curve afforded by the experience and sophistication of the O&G development as well as the economies of its integration into the existing energy infrastructure (Szklo and Schaeffer, 2006).

We identify several opportunities for future research to further our understanding of the relationship between external factors and sustainability goals. First, further research should be conducted to better understand the influence of different types of competition on strategic and functional sustainability goals. We find that companies' responses vary depending on the sources of competition. We assumed that companies would compete with alternative energy players/sources in commercial areas (price and cost) rather than through improving the sustainability of their practices to remain competitive. But further research is needed to validate this assumption and to identify the mechanisms that can be used by companies to address the competition pressure that can result in "sustainable compromise" between economic, environmental and social goals.

Second, the influence of energy transition on O&G supply chain sustainability is an interesting topic that warrants further investigation. We think that companies in the O&G industry may be benefiting from the policy supports for energy transition to start their own alternative energy project and build expertise in this area, hence the increase of the focus on strategic goals. If this is the case, studies should be conducted to identify the motivation behind this move, the types of alternative energy technologies that are being developed, and the extent of their involvement. Since the characteristics and supply bases of alternative energy sources are different than O&G, studies can also be done to understand how these factors can influence companies' supply chain design and strategies, and how will this affect the sustainability of their supply chain practices. In addition, researchers can focus on understanding how companies can create synergies between their existing business and areas of expertise with alternative energy sources to exploit the complementary benefits that can be gained towards improving supply chain sustainability.

Third, another opportunity for additional research concerns the distinction between upstream and downstream companies. The effect of the external factors, stakeholder pressure for example, may be different upstream where companies have to deal more with risks related to ownership and access to reserves compared to downstream companies, which deal with supply and consumer related risks. Our survey did not allow us to reach separate conclusions for these groups, partly due to the involvement of companies in overlapping business sectors. A sampling strategy that would distinguish these business sectors could help in determining the differences. Furthermore, a bigger sample size will help to increase the reliability of our findings. Fourth, longitudinal or case studies may be conducted to gain better understanding on how the factors can affect supply chain sustainability goals and how companies adapt to the dynamics of their business environment. Finally, further study could also be conducted to explore the effects of different stakeholder groups, for example commercial and non-commercial, as well as internal motivations to compete on supply chain sustainability goals.

7. Unique contributions

There are three unique contributions of this study in furthering our understanding regarding SSCM practices in the O&G industry. The contributions are as follows.

First, we examine six external factors within the O&G industry business environment that could influence its supply chain sustainability goals. The six external factors, i.e. political stability, economic stability, stakeholder pressure, competition, energy transition and regulations, until now have not been examined in a single study specific to the O&G supply chain context (or even in the broader SSCM field). We argue that companies in the industry will implement sustainable supply chain strategies that are able to align their internal capabilities with the pressures exerted by external business environment factors in order to achieve the companies' supply chain sustainability goals. Therefore, it is important to increase our understanding of the external factors that could affect SSCM strategies of companies in the industry.

Second, this study positions supply chain sustainability goals as an important element that determines SSCM strategy by explicitly examining how the goals can be influenced by external business environment factors. This is the first study that examines such relationship and among very few researches that explicitly incorporates sustainability goals in an SSCM framework. Furthermore, we are able to distinguish two types of sustainability goals that companies in the O&G industry pursue, namely strategic supply chain sustainability goals and functional supply chain sustainability goals. We think that this is an important finding because our analyses reveal that the relationships between the external factors and the sustainability goals vary. This will eventually influence the SSCM strategies that companies use to achieve the goals.

Finally, we are also able to demonstrate the context dependency of companies' responses to external pressures, specifically, in terms of the differences in companies' responses to different sources of competitions and regulatory pressures. We found that companies will reduce their focus on the strategic sustainability goals when they face greater competition from other energy companies and sources such as renewable and low carbon energy companies. An increase in competition from within the O&G industry itself, however, leads to higher focus on the functional sustainability goals. We also found that increased regulatory pressure can drive companies to focus more on SHE management. However, the pressure has a negative effect on companies focus on energy security. These findings show the interest-seeking nature of companies and that their responses to external pressures vary depending on its context.

8. Conclusion

Through this study we are able to understand the relationship between external business environment factors and supply chain sustainability goals of companies in the O&G industry. The external factors are often beyond companies' control due to their complex interrelationships, which creates sustainability pressure that can influence the companies' survival. In order to overcome the pressure, the companies must develop supply chain management strategies that are able to exploit their existing internal resources and capabilities or acquire new ones. Formulation of internally consistent supply chain sustainability goals will facilitate the alignment between the external pressure and internal capabilities. It could also create synergies among different departments and supply chain functional areas towards better SSCM practices to achieve companies' sustainability goals.

In conclusion, this is one of the very few studies, if not the only study, that has considered the influence of external factors on sustainability goals that determine the SSCM strategies of companies in the O&G industry. Our findings should be useful as research results in their own right and for managers to identify the factors that should be taken into consideration in the design of effective SSCM strategies.

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