Firm size implications for environmental sustainability of supply chains: Evidence from the UAE

Abstract

Purpose – Effective environment and climate change management require supply chain-wide focus (from the initial design to the end-of-life management) as well as universal participation and commitment of firms. However, the environment-related role and contribution of different sized firms in the supply chain are unclear from previous research which this study seeks to clarify using the context of UAE's construction sector.

Design/methodology/approach – Using data collected from a structured survey (455 responses) and semi-structured interviews with 20 key supply chain stakeholders, the study analyses and understands hypothesized differences between small and medium firms (SMEs) and large firms on three key supply chain environmental sustainability aspects: the extent of green supply chain practices (GSCP) implemented, the strengths/influences of drivers and barriers affecting the implementation of GSCP, and the associated environmental, cost-related, and organizational performance benefits derived from GSCP.

Findings – Large firms were found to show significantly greater levels of implementation of GSCP, greater internal drive for implementation, and lower barriers to implementation than SMEs. SMEs though were found to be not too far behind large firms with regards to the environmental, cost-related, and organizational performance benefits from GSCP implementation.

Practical Implications - Findings from the study is useful for benchmarking the GSCP implementation of large firms and SMEs, influences of drivers and barriers affecting the implementation of GSCP, and associated performance benefits derived from GSCP implementation. Policymakers and practitioners could use the study findings to develop suitable policies/interventions so as to ensure that all firms irrespective of their size can contribute equitably towards improving the environmental sustainability of supply chains.

Originality/value – This study is arguably the first comprehensive attempt to understand how various environmental sustainability aspects in supply chains are perceived and performed by SMEs and large firms.

Keywords: environmental sustainability, firm size, green supply chain practices, drivers, barriers, performance

1. Introduction

Environmental pollution and climate change have emerged as one of the major challenges of the twenty-first century with governments worldwide racing to curb their countries' environmental impacts (Saleh and Al-Swidi (2019). Evidence of this is the recently signed Paris climate deal to which more than 200 countries agreed (Salawitch et al., 2017). A country-wide endeavour though, requires a supply chain-wide focus (from initial design to end of life management) to minimise the negative environmental effect of

the supply chain activities across all the major polluting sectors (Ahi and Searcy, 2015; Mangla, 2019). This is even more critical in developing countries/emerging economies, driven by the need to meet the growing demands of rising populations and their pursuit for rapid urbanisation and economic modernization (UNEP-SBCI, 2014). However, curtailing the adverse environmental impacts of supply chains mandates large scale (environmental) commitment and participation of all key supply chain stakeholders. In other words, all supply chain members need to align to the same goal of improving environmental performance (Piyathanavong et al., 2019). However, herein lies the problem: not all firms take their environment-related obligations seriously (Dasgupta et al., 2001); or alternatively, even if they do, they are unable to generate the same level of environmental performance as the others (Reinhardt, 1998). Could firms' different sizes be a factor in their differential willingness/ability on the environmental front? Firm size is an important contingency variable in macro-organisational studies; this question, therefore, has consequences for improving the environmental sustainability of supply chains and which therefore necessitates a multifaceted investigation (that is also the focus of this work):

1) We first need to understand from a GSCP implementation perspective; whether SMEs and large firms differ in their extents of implementation of GSCP, where it was greater, and the rationale for the difference, with all of this understanding needing to be at an individual practice level (as it could be different for each). The previous literature is unclear on this: while some studies highlight large firms, given their greater resources, doing more implementation (Grant et al., 2002), others disagree (for e.g. Rao, 2002). Findings on this aspect would enable policymakers and practitioners to support the implementation-wise-deficient firm size category (large/SMEs) for each practice individually.

2) Next, we need to know from a drivers and barriers (to GSCP implementation) perspective; whether the strengths/influences of those drivers and barriers differ for large firms and SMEs, and if so, the nature and reasons for the difference. The previous literature is incomplete and unclear on this as well: while some drivers and barriers haven't been studied at all from this perspective (for e.g. barriers like shortage of environmental professionals), there is a lack of consensus on the others; for example, government regulations' strength/influence (as a driver) is reported as both greater (e.g. Baylis et al, 1998) and smaller (e.g. Darnall et al., 2010) for large firms vis-a-vis SME's. The weaker drivers and stronger barriers for each firm size category (large, SMEs) so identified could then be strengthened and weakened respectively so that both firm size categories are similarly effective in GSCP implementation.

3) Finally, it is important to know from a performance benefits (from GSCP implementation) perspective; whether the extent of those benefits (in environmental and economic terms), differ for large firms and SMEs, and if so, the reasons for the difference. The benefits-wise laggard firm size category could then be specifically supported through financial and other incentives including training programs to help it overcome this handicap. However, here again, the previous literature is insufficiently clear: while some studies (e.g. Vijayvargy et al., 2017) report higher environmental performance benefits for large firms (vis-à-vis smaller ones) from GSCP implementation, the converse is noted by others such as Grant et al. (2002). This is also the case for long-term economic (or organizational) performance benefits from GSCP implementation; the few studies that have been done have reported both greater (e.g. Younis and Sundarakani, 2019), and similar performance benefit (e.g. Weng et al., 2015) for large firms vis-à-vis smaller firms. Similarly, the few relevant ones on short-term economic (or cost) performance benefit show a lack of consensus with both greater (e.g. Vijayvargy et al., 2017), and similar performance benefit (e.g. Zhu et al, 2007) for large firms vis-à-vis smaller firms being reported.

A comprehensive investigation of the above kind that covers firm size's influence on the different dimensions of supply chain environmental sustainability is not seen in the previous literature. Most previous studies have focused on only specific dimensions and sub-dimensions (for e.g. GSCP implementation and firm size, or environmental drivers and firm size and specific ones within each). Importantly, where studies have looked at the same dimension and/or sub-dimension, there is a lack of consensus on the firm size's influence.

Therefore, this study aims to understand the firm size implications for environmental sustainability of supply chains. The specific objectives are as follows:

a) Assess the extent of implementation of GSCP among SMEs and large firms and to comprehend the reason for the differences (or lack thereof) in the implementation between the two size categories.
b) Assess the strengths/influences of drivers and barriers to the implementation of GSCP for SMEs and large firms and to comprehend the reason for the differences (or lack thereof) in their strength/influence between the two size categories.
c) Understand the extent of the environmental and short- and long-term economic performance benefits of implementing GSCP for SMEs and large firms and to comprehend the reason for the differences (or lack thereof) in the performance benefits between the two size categories.

The findings of the study are expected to help governments and concerned stakeholders develop informed policies, strategic interventions, and support mechanisms so that all firms, regardless of their size, can promote and contribute to their countries' environmental goals to the best of their abilities.

To get a focused understanding, we carefully considered a specific context: the construction sector in the UAE. This is because, among the sectors, the construction sector is the single largest contributor, responsible for one-third of global carbon emissions, one-third of global resource consumption, 40 per cent of the world's energy consumption, 40 per cent of global waste generated and 25 per cent of the world's total water consumption (UNEP-SBCI, 2014). Moreover, given that the construction supply chain is highly complex, diverse and fragmented that involves a multitude of stakeholders (Rezgui and Miles, 2009), greening the sector requires a supply chain-wide focus (from the initial design to the end-of-life management) involving all key stakeholders (Balasubramanian and Shukla, 2017a). Further, the construction sector supply chain carries a healthy mix of large firms and SMEs. Finally, UAE is one of the fast growing emerging economies in the world, and therefore this research addresses calls in the literature to study emerging economies, which is relatively unexplored in comparison to emerged economies (Mangla, 2019).

The rest of the paper is structured as follows: In the next section, firm size and supply chain environmental sustainability literature are reviewed to highlight gaps, establish a theoretical basis and develop related hypotheses. In section three, we explain the research setting and the methodology used, while the findings are discussed in section four. Finally, we conclude in section five, where the study's implications and limitations along with suggestions for future work are discussed.

2. Literature review and hypotheses development

2.1. Firm size and green supply chain practices (GSCP) implementation

GSCP are initiatives by a firm to minimize the negative environmental impacts of its supply chain activities starting from the initial design to the end-of-life management (Balasubramanian and Shukla, 2017b; Younis et al., 2019), and which are classified as "external" or "internal" depending on whether external or internal stakeholders are involved (Zhu et al., 2012). Based on the literature including the works of Seuring and Muller (2008), Zhu et al. (2012) and Malviya and Kant (2015), these are: External ones: environmental design, environmental purchasing, environmental transportation, environmental construction/manufacturing and end of life environmental practices with more details on sub-practices within each given in Appendix 1; Internal ones: environmental management systems (EMS), environmental training, environmental auditing, cross-functional integration for environmental sustainability and environmental-related R&D.

A review of the previous literature reveals knowledge on firm size and GSCP implementation to be limited and fragmented: most studies appear to have focused on one/few practices; for example, Zhu et al. (2007) on eco-design and environmental purchasing and Darnall et al. (2010) on Environment related R&D. The other interesting aspect is a lack of consensus on the firm size's influence. For example, for eco-design, while some studies suggest its implementation at large firms to be greater (e.g. Vijayvargy et al., 2017), others note it to be lesser (e.g. Zhu et al., 2007) and still others equivalent (e.g. Gonzalez et al., 2008) vis-à-vis SMEs. Such conflicting findings are seen for construction as well: while Qi et al. (2010) showed large contractors to be doing more green construction practices, Begum et al. (2009), found small contractors doing more waste management than large ones.

Greater implementation of GSCP at large firms (vis-à-vis SMEs) could be on account of their greater access to/availability of resources and their greater capabilities/expertise on implementing green/environmental practices (Qi et al., 2010). However, their greater bureaucracy and consequential organizational inertia could be an impediment (Miller and Chen, 1994) where SMEs would have an advantage. SMEs are nimble with simpler decision-making processes and greater flexibility and propensity for innovation (Dean et al., 1998); they can, therefore, implement environmental practices more effectively than large firms despite being resource disadvantaged (Noci and Verganti, 1999).

Despite the contrasting viewpoints, going with the larger body of findings, GSCP implementation overall, and for each practice individually can be argued to be greater at large firms. Hence, we propose the following main hypotheses (H1 and H2) and sub-hypotheses:

H1: Implementation of external GSCP (overall) is greater at large firms than SMEs

H1a: Implementation of environmental design practices is greater at large firms than SMEs

H1b: Implementation of environmental purchasing practices is greater at large firms than SMEs.

H1c: Implementation of environmental transportation practices is greater at large firms than SMEs

H1d: Implementation of environmental construction/manufacturing practices is greater at large firms than SMEs

H1e: Implementation of end-of-life environmental practices is greater at large firms than SMEs

H2: Implementation of internal GSCP (overall) is greater at large firms than SMEs

H2a: Environmental Management System (EMS) and ISO 14001 implementation is greater at large firms than SMEs

H2b: Environmental training provision is greater at large firms than SMEs

H2c: Environmental auditing provision is greater at large firms than SMEs

H2d: Cross-functional integration is greater at large firms than SMEs

H2e: Environment-related R&D is greater at large firms than SMEs

2.2. Firm size and strengths/influences of environmental drivers

Environmental drivers are pressures/motivations that cause firms to implement GSCP. They can originate from outside or within the firm, and which are therefore classified in 'external' or 'internal' terms (Walker et al., 2008). Each of the drivers is discussed separately below given that their strengths/influences for firms of different sizes could be different.

Government environmental regulations: Government regulatory pressure is a key environmental driver given that penalties are imposed for non-compliance (Chang et al., 2018; Mangla et al., 2018a; Saleh and Al-Swidi, 2019). Its relative influence with regards to implementing environmental practices for different sized firms though is unclear from previous research with greater (e.g. Baylis et al., 1998), smaller (e.g. Darnall et al., 2010) and equivalent influence (e.g. Ben Brik et al, 2013) for large firms vis-à-vis SMEs being all reported.

An explanation for large firms facing more regulatory pressure including on environmental regulations could be their greater visibility (Earnhart et al., 2014), although this is contested by others (e.g. Bowen, 2002) as per whom large firms are able to effectively resist/negate these regulations (and thereby related pressures) via corporate buffers and environmental lobbying. Others suggest that SMEs too, given their greater likelihood of being penalized for similar environmental wrongdoings react vigorously to counteract regulatory pressure (Firestone, 2002). Here again, there is a contrary view with Pierce (1998) suggesting that small firms, in fact, receive special exemptions from environmental regulations. Overall, though, we believe regulatory pressure's influence (on GSCP implementation) to be greater for large firms than SMEs. Hence, we propose the following:

H3a: The strength/Influence of governmental regulations (as a driver of GSCP implementation) is greater for large firms than SMEs.

Stakeholder (supply chain) pressure: This is a pressure, mostly coercive, such as a threat to cancel purchasing/selling agreements, blacklisting or non-consideration for future projects exerted by one stakeholder firm on another to implement environmental practices (Darnall et al., 2010).

Only two previous studies appear to have considered stakeholder pressure in relation to firm size and with contrasting findings; while Baylis et al. (1998) found this pressure to be greater, Darnall et al. (2010) found it to be smaller for large firms vis-à-vis SMEs. The strength/influence of stakeholder pressure could be greater for SMEs because of their lower leverage (Gonzalez et al., 2008); SMEs typically rely on a few large firms for their business, where any non-compliance, including environment-related, could be commercially detrimental (Darnall et al., 2010). SMEs are also less likely to invest their limited resources in resisting stakeholder pressure (Darnall et al., 2010) in comparison to large firms with more resources to do so (Bowen, 2002). We, therefore, propose the following:

H3b: The strength/influence of supply chain stakeholder pressure (as a driver of GSCP implementation) is greater for SMEs than large firms

Pressure from non-government organizations (NGOs): NGOs, such as environmental agencies, community groups, and industry associations pressurize firms to be environmentally responsible through public protests, strikes, and calls for boycotts (Qi et al., 2010).

With regards to its influence on different sized firms, we came across two studies in the literature and with contrasting findings; while Darnall et al. (2010) did not find any difference in the strength/influence of NGO pressure for large firms and SME's, Qi et al. (2010), in the case of Chinese construction sector, found large contractors being more pressured by NGOs with regards to environmental practices implementation.

Large firms, being more visible to NGOs, could be facing greater pressure on this account (Russo and Perrini, 2010). Their limited numbers (vis-à-vis SMEs) also make them operationally easier to target (OECD, 2007). On the other hand targeting SMEs is more beneficial as resolving environmental transgressions in their cases is easier and lengthy litigations (seen with large firms) are avoided (Darnall et al., 2010). Despite the contrasting views, going with the greater weight of evidence, we propose the following:

H3c: The strength/influence of non-government organization (NGO) pressure (as a driver of GSCP implementation) is greater for large firms than SMEs

Consumer pressure: With increasing environmental awareness, consumer pressure has become a major driver for environmentally responsible practices. However, only two studies were identified in the literature on the strength/influence of this pressure vis-à-vis firm size, and who report inconsistent findings: relatively greater consumer pressure on large firms (Darnall et al, 2010) and equivalent pressure on large and small firms (Ben Brik et al., 2013).

Large firms tend to face greater consumer pressure because of their greater visibility and larger customer base (González-Benito and González-Benito, 2006); also that consumers are less interested in the activities of small firms as their environmental impacts are believed to be small (Smith et al., 2000). On the other hand, SMEs tend to have a niche strategy based on strong relationships with a small customer base; ignoring consumer pressure including environment-related therefore tends to be more difficult/costlier for them (Amato and Amato, 2007). Despite these countervailing arguments, going by the first logic, we hypothesize the following:

H3d: The strength/influence of consumer pressure (as a driver of GSCP implementation) is greater for large firms than SMEs.

Competitor pressure: This refers to the pressure faced by firms to imitate/mimic the actions of their successful competitors (in this case from an environmental perspective) so as not to be competitively disadvantaged (Sarkis et al., 2011). Only one previous study (Ben Brik et al., 2013) has looked at how this pressure could vary depending on firm size though no difference between large firms and SMEs was found on this account. However, intuitively, we can argue that SMEs, given their significantly greater numbers (in comparison to large firms), would be facing more competition including on the environmental front. Hence, we propose the following hypothesis:

H3e: The strength/influence of competitor pressure (as a driver of GSCP implementation) is greater for SMEs than large firms.

Environmental commitment: This refers to a firm's voluntary, rational desire to embrace environmental practices that are consistent with the obligations and values of the society in which it operates (Hsu et al., 2013).

Evidence from the literature on this is mixed. Baylis et al. (1998) in UK general manufacturing and Abidin (2010) in Malaysian construction sector contexts highlight large firms' environmental commitment to be greater than small firms. However, Darnall et al. (2010) showed large firms' environmental commitment to be less than small firms, while Zhu et al. (2008) found the commitment to be similar across different-sized firms. Large firms' greater commitment could be because of their strategy to maintain environmental leadership (Baylis et al., 1998). On the other hand, SMEs, by their very nature (fewer employees and lower bureaucracy), have a greater ability (such as in terms of coordination and communication) to foster environmental commitment and develop a related vision, mission and policies (Besser, 1999). However, overall, again going with the greater weight of evidence, we hypothesize the following:

H3f: Environmental commitment (as a driver of GSCP implementation) is greater at large firms than SMEs.

Business benefits: Firms are motivated by business benefits, such as cost reduction and reputation/brand image enhancement when deciding to implement environmental practices (Seuring and Muller, 2008). The limited evidence on this though (two studies) provides a conflicting picture; business benefits are highlighted as a relatively bigger driver for large firms by Baylis et al. (1998) and an equivalent level driver to SME's by Ben Brik et al. (2013). Some anecdotal evidence of business benefits being a bigger driver for large firms has been provided for construction (Serpell et al., 2013).

Logically, it makes sense for large firms, given their greater scale, to have greater cost-saving potential/business benefits (Baylis et al., 1998). Simultaneously, for SMEs, the business benefit from GSCP could easily be outweighed by the (high) upfront cost of implementation. We, therefore, propose the following:

H3g: The strength/influence of business benefits (as a driver of GSCP implementation) is greater for large firms than SMEs

2.3. Firm size and the strengths/influences of environmental barriers

Environmental barriers are hindrances/challenges that prevent firms from implementing GSCP and these can also be of external or internal origin (Walker and Jones, 2012). Each of the barriers and the hypothesized differences in their strengths/influences for different-sized firms are discussed below:

Shortage of environmental professionals: Though anecdotally discussed, no previous study was found to have actually investigated the strength/influence of this barrier vis-à-vis firm size. However, intuitively, it can be argued that large firms, because of their superior resources and capabilities, are relatively better placed. They can offer more attractive salary packages to hire certified environmental professionals from overseas, train/certify existing employees to become environmental professionals and outsource some of their environment-related activities. We, therefore, propose the following:

H4a: Shortage of environmental professionals is a greater barrier (to GSCP implementation) for SMEs than large firms

Shortage of local environmentally friendly/green suppliers: This again has been only anecdotally discussed with no previous study investigating its relevance (as a barrier) for firms of different sizes. Here again though, large firms can be argued to be relatively better placed; large firms could leverage their scale to source from overseas suppliers at competitive supply/credit terms. This would be difficult for small firms and imports for them would be more expensive. Hence we propose the following:

H4b: Shortage of local environmental/green suppliers is a greater barrier (to GSCP implementation) for SMEs than large firms

The high cost of implementation: Implementing GSCP is expensive; large investments are needed for example on energy-efficient and less-polluting equipment, on environmental management systems and related certifications, and environmentally friendly (i.e., recycled and non-hazardous) materials (Liu et al., 2012). Previous studies have shown that any financial problems related such as availability of funds would adversely influence the implementation of GSC practices (Mangla et al., 2015).

With regards to the strength/influence of this barrier for different sized firms, only one study - Min and Galle (2001) - has investigated the same; the barrier was found to be greater for SMEs. This is in line with the conventional wisdom that significant financial resources are needed for implementing GSCP where SMEs are at a disadvantage. However, SMEs can use their resources more innovatively as they are not encumbered by bureaucratic structures/processes seen in large firms (Jones and Klassen, 2001); this is supported by the fact that firms with greater environmental practices implementation are not always the ones with greater financial resources (Hitchens et al., 2005). Despite these counter-arguments, we still propose the following:

H4c: High cost of implementation is a greater barrier (to GSCP implementation) for SMEs than large firms

Lack of knowledge and awareness: Implementation of GSCP requires sound technical and managerial know-how regarding, for example, the use of environmental tools and techniques, and environmental management standards and certifications (Liu et al., 2012). Lack of this know-how in the workforce, therefore, constitutes a barrier (Mangla et al., 2018b).

Here again, only anecdotal evidence is available; for instance, for construction, Abidin (2010) and Serpell et al. (2013) both highlight greater knowledge and awareness of environmental sustainability amongst large firms. Investigation wise though, only one study (Min and Galle, 2001) has been done, and which found no difference in environmental knowledge and awareness as a barrier for SMEs and large firms.

SMEs, despite their willingness to be more environmentally active, are known to be more 'eco-illiterate' (Kostka et al., 2013). However, they do have a greater propensity to innovate and to proactively adopt environmental practices (Noci and Verganti, 1999). Overall though, going with the greater weight of evidence, we propose the following:

H4d: Lack of knowledge and awareness is a greater barrier (to GSCP implementation) for SMEs than large firms

2.4. Firm size and performance benefits from implementing GSCP

The primary reason for implementing GSCP is to improve environmental performance; however, the economic dimension (both short-term/cost-oriented and long-term/organizational) is also important so that investments in those practices can be justified.

Knowledge of the extent of performance benefits (from GSCP implementation) for different-sized firms is important. First, evidence of a comparable level of benefits for SMEs (vis-à-vis large firms) could encourage them to implement GSCP. Second, it would enable support mechanisms, such as financial support, incentives, tax discount, training and preferential treatment to be deployed towards the performance-wise deficient firms (SMEs or large firms) to increase their implementation levels.

Firm size and environmental performance benefits: The key environmental performance benefits from implementing GSCP include reductions in air emissions, material usage, energy and water consumption, hazardous material usage, environmental accidents, and waste generation (Hervani et al., 2005; Green Jr et al., 2012).

In terms of previous literature, some studies show greater (e.g., Vijayvargy et al., 2017; Younis and Sundarakani, 2019; Younis et al., 2019), some lower (e.g., King and Lenox, 2001) and some equivalent (e.g., Zhu and Sarkis, 2004) environmental performance benefit for large firms in relation to SMEs, thereby showing a conflict. With regards to construction, the lone study (Chang et al., 2018) reports large construction firms in China showing better environmental performance. UAE focused studies also report greater environmental performance benefits for large firms vis-à-vis smaller firms (Younis and Sundarakani, 2019; Younis et al., 2019)

Large firms' greater environmental benefits could be attributed to their greater efficiency and effectiveness of implementing GSCP which in turn could be due to their clearer specification of environmental goals, use of more formalized organizational procedures and performance measures and greater access to resources to monitor, report and control performance (Vijayvargy et al., 2017). The lower or equivalent environmental performance benefit for large firms (vis-à-vis SMEs) on the other hand, could be due to corporate greenwashing, where firms only give an appearance of GSCP implementation without realizing any benefits in practice (Earnhart et al., 2014).

Despite the lack of clarity, as per the arguments above, the bias is towards large firms. We, therefore, propose the following:

H5: The overall environmental performance benefit (from GSCP implementation) is greater for large firms than SMEs.

Firm size and short-term economic (or cost-related) performance benefits: The key short-term economic (or cost-related) performance benefits from implementing GSCP include cost reductions in energy, water, and waste management, in material costs, in environmental penalties, and in fines (Chen et al., 2010; Green Jr et al., 2012).

However, no study on construction appears to have investigated these benefits vis-à-vis firm size. The (limited) evidence available from other sectors also shows a lack of consensus with large firms showing greater benefit (Vijayvargy et al., 2017) and large firms and SMEs showing equivalent benefit (Zhu and Sarkis, 2004) being both reported. Nevertheless, similar to the arguments put forth for environmental performance, large firms can be expected to show greater cost-performance benefit than SMEs because of their greater access to resources for establishing, monitoring, and reporting performance and their greater economies of scope and scale (Bianchi and Noci, 1998). Hence, we propose the following:

H6: The overall cost-performance benefit (from GSCP implementation) is greater for large firms than SMEs

Firm size and long-term economic (or organizational) performance benefits: The long-term economic (or organizational) benefits from implementing GSCP include increases in sales, sales prices, market share, profits, and return on investments (Vijayvargy et al., 2017).

We did not come across any study on construction that has investigated this issue. However, the findings of Younis and Sundarakani (2019) and Younis et al. (2019) on the UAE manufacturing sector shows that organizational performance benefits from implementing GSCP is greater for large firms vis-à-vis smaller firms.

The greater performance seen at large firms could be because of their better organization, resource advantage, and visibility among governments, environmental bodies, NGOs, consumers and investors. Large firms also tend to associate more with environmentally prestigious products and projects that involve premium customers. The resulting higher sales coupled with lower costs from economies of scale and scope mean greater profits from GSCP implementation for large firms. In contrast, SMEs are known to tackle environmental issues in a reactive or ad-hoc/short-term manner (Sarkis and Dijkshoorn, 2007). However, this is contested in some studies. For example, Hoogendoorn et al. (2015) showed small firms to be much more innovative on specialty environmental products and services in the niche markets they typically operate in and being able to outcompete the large firms on market share and profits. However, going with the greater weight of evidence, we propose the following:

H7: The overall organizational performance benefit (from GSCP implementation) is greater for large firms than SMEs.

Figure 1 below conceptualizes our research questions and hypotheses.

Figure 1

3. Research methodology

3.1. Research setting

United Arab Emirates (UAE)'s construction sector was chosen as the setting for the investigation; choosing a specific context allowed for a detailed in-depth study and was therefore chosen. In any case, the sector contains various sub-segments: Developers (business owners), Architects/Consultants (service providers), Contractors/Sub-Contractors (integrators), and (material and equipment) suppliers which together mirror a wide spectrum of different sectors and industries (DBIS, 2013).

From a size perspective too, a typical construction project involves hundreds, if not thousands, of firms of varying sizes (DBIS, 2013). Moreover, in the UAE construction sector's case, the market share is almost evenly split between SMEs (52%) and large firms (48%); discriminating firm size's influence on environmental management is therefore easier. Lastly, UAE has witnessed significant environmental initiatives in recent years in line with its vision to become one of the most sustainable countries by 2021 (UAE Vision 2021, 2018), though it currently is one of the highest per capita carbon emission countries in the world (World Bank Country Report of UAE, 2018). UAE, therefore, provides a good setting for understanding how SMEs and large firms are contributing to enhancing the environment-related aspects of a country while keeping pace with urbanization and modernization.

This study utilizes a sequential mixed methods design similar to other studies in the domain (e.g., Younis et al., 2019) to gain a richer understanding on the impact of firm size on the different dimensions of supply chain environmental sustainability.

3.2. Phase 1 – Survey research (quantitative)

3.2.1. Development of the survey instrument

The insights obtained from the literature were used to develop the survey instrument (Appendix 1) along the four dimensions of environmental sustainability, i.e., green supply chain practices (GSCP) implementation, environmental drivers, environmental barriers and performance benefits (environmental, cost and organizational) from GSCP implementation. As regards the survey scale, a Likert scale was used to evaluate the environmental dimensions/sub-dimensions, and which is similar to that used in other studies on this subject (Green Jr et al., 2012). For green supply chain practices, respondents' opinions are captured on a scale of 1-5, where 1 indicates that the underlying green supply chain practice is 'not considered at all', whereas 5 indicates the underlying green supply chain practice is 'highly considered'. Similarly, for environmental drivers and barriers, respondents' opinions are captured on a scale of 1-5, where 1 indicates that the underlying driver/barrier had 'no influence at all', whereas 5 indicates 'very high influence'. For performance dimensions, the extent of performance improvement was captured on a Likert scale of 1-5, where 1 indicates performance improvement is 'very low extent', whereas 5 indicates the improvement is 'very high extent'. Number of employees in the organization was used to capture firm size. Accordingly firms are classified as SMEs and large firms. We used the popular classification proposed by the European Union (SMEs: <250 employees; large firms: >250 employees),

which is similar to the definition used in the UAE (European Commission, 2015; SME, 2013). After developing the initial survey instrument, further improvements were made based on a pre-test with 12 senior managers and 3 academics as well as a pilot study involving 59 participants.

3.2.2. Sampling and survey administration

The purposive, matched-samples design of this study allows us to look at the effects of one variable (in this case, firm size) by controlling for other variables, such as firm ownership and firm age. The Zawya database (which we paid to access) and one of the author's personal LinkedIn contacts were utilized to filter respondents through advanced profiling based on firm size and employees' designation or role in the firm and other firm characteristics, such as ownership and age. The study design allowed us to not only ensure a reasonable representation of both SMEs and large firms in the sample but also control for the extraneous effects of firm ownership and firm age (if present) by ensuring that they were similarly present across the two groups.

The survey instrument was administered via email using Qualtrics, a web-based survey system. A total of 455 usable responses were obtained, and the responses are almost evenly split between SMEs and large firms (Table 1).

Table 1

3.2.3. Data validation

Before proceeding with hypothesis testing, we checked the data for non-response bias and common method bias. For non-response bias, the responses of early and late participants were compared based on the assumption that the opinions of late respondents are representative of the opinions of theoretical non-respondents (Rogelberg and Stanton, 2007). A t-test revealed no significant difference between the two groups for each of the items, indicating non-response bias to be not a problem (Armstrong and Overton, 1977). With regards to common bias, procedural remedies, as suggested by Podsakoff et al. (2003), were undertaken prior to data collection; these included re-assuring respondents about data confidentiality and anonymity to encourage them to respond as honestly as possible, and conducting a pre-test and a pilot test of the survey instrument to improve content and face validity so that the questionnaire was easily understood. Common method bias was tested using Harman's single factor test, one of the most widely used methods where all the items are loaded onto one construct (factor) using exploratory factor analysis (EFA) (Podsakoff et al., 2003). As per this test, while the constrained one-factor EFA accounted for only 26.1 percent of the variance, the unconstrained nine-factor model explained 79.2 percent of the variance, thereby indicating that common-method bias was not a major issue in this study.

3.2.4. Construct validity

Given that multi-item measures were used to assess the environmental dimensions and sub-dimensions of green supply chain practices, environmental drivers, environmental barriers, and performance benefits, it is important to establish their statistical appropriateness.

Convergent validity: Confirmatory factor analysis (CFA) was done to assess the convergent validity of the constructs considered (see results in Appendix 1). All items were loaded to their respective construct with factor loadings greater than 0.50, indicating that the constructs have strong convergent validity (Anderson and Gerbing, 1988).

Discriminant validity: A series of pair-wise CFAs were done by forcing measures of each pair of constructs into a single underlying construct and checking for any significant deterioration in model fit relative to a two-factor model (Anderson and Gerbing, 1988). The pair-wise tests conducted separately for GSCP, environmental drivers, environmental barriers, and performance benefits showed significant deterioration in model fit for all cases, thereby demonstrating strong discriminant validity.

Construct reliability: Using Cronbach's alpha, the reliability of each construct operationalized in this study was verified. Larger values indicate better consistency in the measurement. Nunnally (1978) suggests that Cronbach's alpha should be at least 0.5 and, ideally, higher than 0.7. The Cronbach's alpha values of the constructs are shown in Appendix 1. They were well above 0.7 for all constructs, except for the internal barrier construct (0.68), which was within the acceptable limit.

3.3. Phase 2 – Interviews (qualitative)

In this phase, we sought to improve understanding and explain differences in environmental sustainability across SMEs and large firms. For the interviews, organizations were purposively sampled and so chosen as to ensure equal representation of SMEs and large firms as well as all key construction sector stakeholders (i.e., developers, architects/consultants, contractors/subcontractors, and material suppliers). Multiple respondents were considered from each organization in order to get a holistic perspective. A total of 20 semi-structured interviews with senior professionals, most of whom had more than ten years of experience in the construction sector, were conducted across 10 firms (5 large and 5 SMEs). Demographic details about the respondents are presented in Table 2.

The detailed interview protocol used in this study is given in Appendix 2. Similar questions were posed to each respondent; they were of the nature of 'what', 'how', 'how much' and 'why' to understand environmental drivers, barriers, green supply chain practices and performance aspects.

The interviews, all of which were conducted face-to-face, covered GSCP, drivers, barriers and performance benefits. Each interview lasted approximately 45–60 minutes. Most were digitally recorded, and where this was not possible, detailed notes were taken. All were transcribed within 48–72 hours of the interview and cross-checked with the respondents for accuracy. Also, relevant secondary data such as annual reports, newsletters, tender documents, internal performance/audit reports, and departmental publications were sought to complement the interview findings.

Thematic analysis was used to analyze the interview data, which was grouped into nine sub-categories: external and internal drivers; external and internal barriers; external and internal GSCP; and environmental, cost-related/economic, and organizational performance. Codes were assigned to individual aspects within these sub-categories. For example, government regulation, a driver of GSCP, was assigned a specific code within sub-category 1 (external driver, and environmental commitment was

assigned a specific code within sub-category 2 (internal drivers). The same procedure was repeated for environmental barriers, GSCP, and performance benefits for SMEs and large firms.

4. Findings and Discussion

In this section, the survey and interview findings are discussed in relation to the research questions. First, we discuss our hypotheses test results. The independent sample t-tests, the most common statistical method for evaluating differences in means between two independent groups (in this case, between SMEs and large firms) was used to test our hypotheses. Next, for each hypothesis, the findings of the interviews are discussed in sequence to enrich the understanding of why certain phenomena exist.

4.1. GSCP Implementation Related

Tables 3 and 4 show the extent of implementation of external and internal GSCP respectively for SMEs and large firms. Looking at SMEs first, as seen in table 3, the overall external GSCP implementation was found to 3.5 out of 5.00. At the individual level, eco-design and environmental construction/manufacturing emerged to be the most implemented practices with a score of 3.8, followed by environmental purchasing (3.5), environmental transportation (3.3), and end of life environmental practices (3.2), which emerged as the least implemented practice. Similarly, as seen in table 4, the overall internal GSCP implementation was found to be at 3.5 out of 5.00. At the individual level, environmental management system (EMS) and ISO 14001 emerged to be the most implemented practice with a score of 3.9, followed by environmental training (3.8), cross-functional integration (3.8), environmental auditing (3.4), and environment-related R&D (2.7), which emerged as the least implemented practice. In sum, it can be gauged that GSCP implementation at SMEs is moderate with significant scope for improvement, especially for practices such as end of life environmental practices and environment-related R&D.

In the case of large firms, as seen in table 3, the overall external GSCP implementation was found to 3.9 out of 5.00. At the individual level, environmental construction/manufacturing emerged to be the most implemented practice with a score of 4.3, closely followed by eco-design (4.2) and environmental purchasing (4.0). Environmental transportation (3.7) and end of life environmental practices (3.7) emerged as the least implemented practices. Similarly, as seen in table 4, the overall internal GSCP implementation was found to be at 3.9 out of 5.00. At the individual level, environmental Management System (EMS) and ISO 14001 emerged to be the most implemented practice with a score of 4.3, followed by environmental training (4.2), cross-functional integration (3.9), environmental auditing (3.9), and environment-related R&D (3.3), which emerged as the least implemented practice. In sum, it can be gauged that GSCP implementation at large firms is moderately high, though there is still scope for improvement, especially for practices such as environmental transportation, end of life environmental practices, and environment-related R&D.

Next, looking at the differences in implementation between SMEs and large firms, the t-values and p-values show that, except for cross-functional integration, the extent of implementation of individual external and internal GSCP as well as in overall terms are significantly greater and consistent across all practices for large firms vis-à-vis SMEs, (mean difference [δ] of 0.4–0.6) thereby supporting our hypotheses (H1 and H2). At the overall level, for external GSCP, the mean difference, δ=-0.4, significant at t=-4.27, p<0.001. At the individual level, the mean difference for eco-design is δ=-0.4, significant at t=-

2.71, p<0.01; environmental purchasing is δ=-0.5, significant at t=-4.53, p<0.001; environmental transportation is δ=-0.4, significant at t=-3.00, p<0.01; environmental manufacturing/construction is δ=-0.5, significant at t=-3.47, p<0.01; and end of life environmental practices is δ=-0.5, significant at t=-3.25, p<0.01.

Table 3

Table 4

The interviews supported these findings. For example, renewable energy from photovoltaic panels for some projects for a large Developer interviewee was found to be 12-15% of total energy requirements; the corresponding figure for the SME developer was only around 5%. Similarly, the use of modular design to promote pre-fabrication and for ease of disassembly (for end-of-life material recovery) was found to be more in large Developer projects. Also, the stringency of environmental aspects considered in the pre-qualification stage of supplier selection such as the number of LEED-certified staff in payroll, the previous track record of green projects, and ISO 14000 certification, was found to be greater for large Developer projects. Further, to reduce transportation-related environmental impacts, a more concerted effort was seen at the large contractor (vis-à-vis the SME one) with regards to choosing geographically closer suppliers and scheduling material deliveries during periods of less traffic congestion. The large contractor was also found to use more automated on-site construction equipment and segregate waste; also, with regards to demolition projects undertaken, the contractor was found to make efforts to use energy-efficient demolition equipment, selectively dismantle buildings and safely dispose of hazardous materials. No such end of life practices was found to be considered by the SME contractor. Similarly, in the case of (material) suppliers, the large supplier interviewed was found to use state of the art manufacturing equipment and technology (imported from countries such as US and Germany) that consume lesser energy, cause lesser emissions and lower (manual related) wastage/ errors. This was not the case for the SME supplier.

The underlying reasons for the above differences between SMEs and large firms were also evident from the interviews. For instance, it was evident for all stakeholders that the implementation of GSCP is very resource and knowledge-intensive. The interviews revealed SMEs lack skilled human resources to carry out environmental purchasing, which involves considering the environmental aspects of every contract that may number in thousands. It was also found that large firms' strong financial resources are a significant asset for (their) GSCP implementation. This is because environmental projects were found to require considerable upfront capital investment in, for example, solar water heaters, energy-efficient HVACs, and building management systems. Similarly, because of their financial resources, large contractors and suppliers were found to be able to invest more in innovative machinery, equipment and automation technologies to minimize the adverse environmental consequences of construction/manufacturing. Furthermore, large firms were found to have a greater dedicated budget for environment-related R&D, which was not the case for SMEs. In fact, some SMEs highlighted cash flow as

a general concern. The interviews also revealed that large firms conduct frequent, diverse in-house and external training, while SMEs generally train their own employees. Further, employees in large firms were found to have more opportunities to enroll in environmental certification programs; this is because of these firms having in-house expertise, such as dedicated training departments and/or training managers, and a dedicated budget for funding external training/certifications. In contrast, SMEs were found to limit themselves to short training programs for select employees, offering only a few competitive opportunities for external training/certification. Similarly, large firms were found to conduct both in-house and external audits, with SMEs generally restricted to in-house auditing only. The frequency of environmental auditing was also observed to be much higher for large firms with the rigour also being greater given that reputed international auditors are involved.

Overall, the interview and survey findings both show external and internal GSCP is implemented to a greater extent at large construction firms than SMEs, and which is in line with the findings of Qi et al. (2010) and Begum et al. (2009) for construction and Vijayvargy et al. (2017) and Zhu et al. (2008) in general. The findings also to a large extent reject the notion of some authors that a firm's ability to implement new environmental technologies reduces as its size increases (Hannan and Freeman, 1989) and that large firms show organizational inertia (Miller and Chen, 1994). However, this was seen to be not true for cross-functional integration, as SMEs' relatively smaller size and less bureaucratic structure helped them to be on par with large firms. Overall, the study supports the notion that large firms have the advantage of 'discretionary slack', the opportunity for managers to use excess time and resources for the implementation of GSCP (Gil et al., 2001; Lee, 2008; Zhu et al., 2008) over smaller firms, who may refrain from allocating their rare and limited resources towards GSCP implementation (Darnall et al., 2010; Ben Brik et al., 2013).

From a theoretical perspective, the higher extent of implementation of GSCP among large firms could be explained from a resource-based view (RBV) perspective (Barney, 1991). In the environmental context, referred to as natural-resource-based view of the firm (Hart and Dowell, 2011), the relatively greater availability of key resources witnessed at large firms vis-à-vis smaller firms such as financial resources, human resources, capabilities, and technical and managerial know-how could explain the relatively greater implementation in GSCP seen at large firms (Gonzalez et al., 2008; Zhu et al., 2008; Chang et al., 2018).

4.2. Strengths/Influences of Environmental Drivers Related

Table 5 shows the environmental drivers' strengths/influences for SMEs and large firms; also, the differences (in statistical terms) between the firms on this account. Firstly, H3a, which concerned government regulatory pressure, was not supported. Contrary to our proposed hypothesis, the strength/influence of regulatory pressure was found to 3.5 out of 5.00 for SMEs while it was found to be only 2.9 out of 5.00 for large firms. Moreover, the difference (δ=0.6) was found to be significant at t= 7.81, p<0.001.

The interviewees revealed that UAE environmental regulations for construction sector firms are not differentiated based on firm size. Also, it was evident from the interviews that large firms gave lower importance to regulatory pressure as they considered them less onerous to fulfill than SMEs (who found

them cumbersome/challenging). Another factor that SMEs were seen to consider was that any fines/penalties associated with the breach of regulations would have a significantly greater adverse effect on their operations (e.g., cash flow) than large firms. They also appreciate their limited ability to challenge the regulations. These notions are consistent with previous scholarship suggesting that smaller firms are more likely to respond to regulatory pressures instead of devising corporate buffers against it (Aragón-Correa, 1998; Bowen, 2002; Darnall et al., 2010).

Table 5

With regards to stakeholder pressure on GSCP implementation, the survey results shows the hypothesis (H3b) is supported. This is because, in line with our proposed hypothesis, the strength/influence of stakeholder pressure was found to 3.3 out of 5.00 for SMEs while it was found to be only 2.9 out of 5.00 for large firms. Moreover, the difference (δ=0.4) was found to be significant at t= 4.08, p<0.001.

The results also found support among the interviewees. Stakeholder pressure was found to be relatively greater for SMEs, with all the interviewed SMEs taking this pressure quite seriously. This is because of their reliance on a few large stakeholders/partners for business where non-compliance with environmental requirements could mean being blacklisted and going out of business. The results is consistent with the findings of Darnall et al. (2010), who reported that supply chain stakeholder pressure will be more significant for smaller firms (or lesser for large firms).

With regards to NGO pressure on GSCP implementation, the survey results shows the hypothesis (H3c) is supported. In accordance with our proposed hypothesis, the strength/influence of NGO pressure was found to 2.1 out of 5.00 for SMEs while it was found to be only 2.4 out of 5.00 for large firms. Also, the difference (δ=-0.3) was found to be significant at t= -3.31, p<0.001.

According to the respondents from large firms, they have more visibility and a larger customer base than SMEs; they, therefore, take NGO pressure more seriously as any non-compliance could be more expensive for them. However, the level of the NGO pressure for both SMEs and large firms is low (mean score of less than 2.5 out of 5.00); this can be explained as due to very few environmental NGOs operating in the UAE and who also do not enjoy significant legal backing. Still, the findings support the notion in the literature that large firms are the primary target of NGOs because they are regarded as industry leaders and, thus, must behave in an environmentally-responsible manner that others can follow (Gil et al., 2001; González-Benito and González-Benito, 2006; Qi et al., 2010).

The strength/influence of consumer (i.e., end-user) pressure to implement GSCP (which is relevant only to developers) is greater for large firms than for SMEs, supporting H3d. The strength/influence of consumer pressure was found to 1.6 out of 5.00 for SMEs while it was found to be only 2.3 out of 5.00 for large firms. Also, the difference (δ=-0.7) was found to be significant at t= -4.00, p<0.001.

A large developer respondent revealed that, compared to SMEs, their projects attracted more foreign buyers and UK and UK based investors, who are conscious of the environmental aspects of the project. However, the (lowest) survey score shows this pressure to be the least influential in GSCP implementation. The interviewees indicated that this could be due to UAE investors'/buyers' low level of environmental

awareness, especially with regards to the cost savings and health benefits of green buildings. Additionally, buyers, especially those in lower socio-economic strata, are less willing to pay a premium for green/LEED-certified apartments, given that associated energy and water cost savings are minimal (due to the relatively low cost of water and electricity in the UAE). These factors result in less financial incentive for buyers and, consequently, less consumer pressure for green projects.

Overall, the results is in line with the literature that large firms tend to face greater consumer pressure because of their greater visibility and larger customer base (González-Benito and González-Benito, 2006) and that consumers are less interested in the activities of small firms (Smith et al., 2000).

Finally, no significant difference between SMEs and large firms was found with regards to the strength/influence of competitor pressure, and therefore H3e is not supported. The strength/influence of competitor pressure was found to 3.0 out of 5.00 for SMEs while it was found to be only 2.9 out of 5.00 for large firms. Also, the difference (δ=0.1) was found to be non-significant at t= 1.62, p>0.05.

During the interviews, respondents from both large firms and SMEs acknowledged that they needed to implement GSCP to stay competitive in the market. According to a developer interviewee, *"Sustainability is the future, and soon everybody will be talking about it and we need to be ahead of the game."*

The survey results for internal drivers (refer Table 5) indicate both H3f (environmental commitment) and H3g (business benefits) being supported with related pressures on large firms being greater than that on SMEs. In fact, the difference in pressure between the groups is relatively large. For environmental commitment, the difference (δ=-0.6) is significant at t=-7.49, p<0.001; and for business benefits, the difference (δ=-0.8) is significant at t=-9.81, p<0.001.

The interviews indicated that SMEs had a relatively lower environmental commitment, with most not having a clear environmental policy or reporting method, unlike large firms, whose strategies include environmental aspects. The higher environmental commitment of large firms was described by one developer interviewee as follows: *"Since our environmental impact is not only on land but also at sea, we have taken measures to ensure that aquatic or marine life is not affected by our project, even if it means relocation or building artificial reefs."* This finding is consistent with Abidin (2010), who reported higher environmental commitment among large Malaysian developers compared to SME ones. Also, there is little evidence to support the notion of small businesses being inherently more environmentally responsible (Besser, 1999).

The importance of 'business benefits' as a driver of GSCP implementation was stressed upon more by large firms than the SMEs interviewed, especially the large contractors and (material) suppliers. For example, a large contractor interviewee highlighted the significant cost reduction potential of environmentally sustainable construction practices. Similarly, as per a large developer interviewee, *"Sustainability is considered by our company to avoid reputational risk as well as to achieve reputational gains."* Our results are aligned with the findings of Serpell et al. (2013) as well as those of Baylis et al. (1998), which suggest that this driver is stronger or more influential for large firms because of their greater economies of scope and scale (Bianchi and Noci, 1998). Our results are also supportive of the research suggesting SMEs to be less likely to be driven by business benefits given that these could easily be outweighed by the high cost of implementing environmental practices (e.g., Noci and Verganti, 1999).

4.3. Strengths/Influences of Environmental Barriers Related

Table 5 shows the strengths/influences of environmental barriers for SMEs and large firms as well as the differences between them in statistical terms. Both H4a and H4b can be seen to be supported with the strengths/influences of relevant external barriers being greater for SMEs than for large firms. For shortage of environmental professionals, the strength/influence of the barrier was found to be 3.4 out of 5.00 for SMEs while it was found to be only 2.8 out of 5.00 for large firms. Also, the difference (δ= 0.6) is significant at t=6.38, p<0.001. Similarly, for shortage of local environmental/green suppliers, the strength/influence of the barrier was found to be 3.6 out of 5.00 for SMEs while it was found to be 3.0 out of 5.00 for large firms. The difference (δ= 0.6) is significant at t=6.27, p<0.001.

As evidenced in the interviews, this could be because, large firms have superior resources and capabilities and thus are in a much better position to manage these externalities than SMEs. For instance, representatives of the interviewed large firms viewed a shortage of environmental professionals to not be a huge barrier as they were able to offer attractive packages and get certified environmental professionals from overseas (UK/US/Germany); also in certain cases by certifying their own employees. Large firm interviewees also shared their ability to negotiate favourable terms, such as longer repayment periods and more credit, with foreign suppliers; because of this, they were not too concerned with the lack of local suppliers.

The strength/influence of internal environmental barriers can also be seen to be greater for SMEs than for large firms, supporting both H4c and H4d. For high cost of implementation, the strength/influence of the barrier was found to be 4.1 out of 5.00 for SMEs while it was found to be 3.4 out of 5.00 for large firms. Also, the difference (δ= 0.7) is significant at t=6.60, p<0.001. Similarly, for lack of knowledge and awareness, the strength/influence of the barrier was found to be 3.6 out of 5.00 for SMEs while it was found to be only 2.9 out of 5.00 for large firms. The difference (δ= 0.7) is significant at t=7.02, p<0.001.

Interviewees also opined on these barriers. As per large firm interviewees, they did not consider the high cost of implementation to be a huge barrier as green investments still constituted only a small proportion of their annual (large) turnover. On the other hand, most SME respondents expressed concerns about high costs. In the words of one SME developer interviewee, *"governments and giant developers have taken the lead to construct environmentally friendly projects as they can afford the cost. When it comes to us, the cost is of the essence as budgets are usually very tight."* Another SME Contractor respondent similarly commented: *"...government regulation should also take into account the financial capability of firms; forced implementation of environmental practices such as EMS and ISO 14001 could well mean that we go out of business"*

Overall, the findings support the popular wisdom that SMEs find it more difficult to implement GSCP because of the high cost of implementation (Simpson et al., 2004). Also, the relatively lower influence of this barrier for large firms because of investments in GSCP being only a small part of their (large) asset base (Grant et al., 2002). With regards to the lack of knowledge and awareness, the findings support the arguments in the literature about SMEs having lower levels of eco-literacy than large firms (Kostka et al., 2013).

4.4. Performance Benefits Related

Table 6 shows the extent of environmental, cost-related, and organizational performance benefits (from GSCP implementation) for SMEs and large firms.

Looking at SMEs first, as seen in table 6, the environmental performance benefit was found to 3.5 out of 5.00, followed by cost performance (3.1), and organizational performance (3.1). In the case of large firms, the environmental performance benefit was found to 3.8 out of 5.00, followed by cost performance (3.4), and organizational performance (3.3).

Next, looking at the differences in the performance benefits between SMEs and large firms, the t-values and p-values show that all three performance benefits are significantly higher for large firms vis-à-vis SMEs, supporting hypotheses H5, H6, and H7.

For environmental performance, the mean difference, δ=-0.3 is significant at t=-3.33, p<0.01; while for cost performance, δ=-0.3 is significant at t=-3.20, p<0.01; and for organizational performance, δ=-0.2, is significant at t=-2.26, p<0.01.

Table 6

This picture was further confirmed in the interviews. For example, the manager from a large Aluminum supplier informed that they have reduced their chlorofluorocarbon (CFC) emissions by 50% and waste generation by 10% within two years of implementing environmental manufacturing practices. The interviews also suggested that, apart from economies of scale, the reason large firms enjoy greater environmental performance benefits is because they make concerted efforts to increase their legitimacy among governments, supply chain partners, and foreign markets. Also apparent from the interviews was the fact that large firms closely monitor and report environmental performance; they are therefore able to take timely corrective actions to improve performance. The findings dismiss the notion of corporate "greenwashing" by large firms reported in the literature.

The interviews also supported the better economic/cost performance (from GSCP implementation) for large firms. For example, a large Contractor respondent reported cost savings of $0.19 million from a single project through green construction practices, largely from onsite waste minimization and recycling. Large firm respondents also revealed their performance measures, goals and reporting mechanisms to be quite formal and sophisticated. Finally, the interviews clearly highlighted why organizational performance (from GSCP implementation) was better for large firms than SMEs: the large developers and architects/consultants tended to get involved in large, prestigious projects, which in turn were able to attract environmentally conscious Western buyers and institutional investors who were more willing to pay higher prices than local buyers. According to a large contractor firm respondent, *"Any capital expenditure has to have a good return on investment (i.e., it must pay for itself within few years)."* Moreover, interviewed Architect/Consultant firm respondents highlighted that their involvement in green projects had increased their attractiveness for global tendering as well as the rates of their services. A similar view was shared by a large contractor interviewee: *"our waste reduction efforts received significant*

media coverage and resulted in many Developers approaching us for business". The large supplier respondent similarly claimed that their Aluminum exports to developed countries such as the US and UK increased because of their implementation of GSCP.

In line with the literature, the relatively greater performance benefits at larger firms could be attributed to the clearer specification of performance goals, use of more formalized organizational procedures and performance measures, and greater access to resources to monitor, report and control environmental performance (Zhu et al., 2012; Vijayvargy et al., 2017).

However, it is important to highlight that there is considerable scope for further improvement in benefits (from GSCP implementation) for both SMEs and large firms; the scores range from 3.1 to 3.8 (out of 5) on different performance aspects. Also, to be noted is that the gap in performance benefits between SMEs and large firms is small: 0.2-0.3. This shows that SMEs are not too far behind large firms in terms of deriving performance benefits from GSCP implementation. This support the emerging notion in literature that the corporate attitudes of smaller firms are changing from reactive to proactive (i.e., from command and control to a market- and competition-based approach with regard to implementation of GSCP (Lee, 2009; Hoogendoorn et al., 2015).

5. Implications and Conclusions

The study offers empirical evidence that firm size is an important factor in improving the environmental sustainability of supply chains. It identifies the least and most implemented green supply chain practices, the influence of different environmental drivers and barriers to implementation and the best-and worst-performance aspects (among environmental, economic and organizational) for different-sized firms (specifically large firms and SMEs).

The contribution of this study are two-fold. First, at an industrial level, policy makers and practitioners, could benefit from using this research to develop suitable policies/interventions so as to ensure that all firms irrespective of their size can contribute equitably towards supply chain environmental sustainability. Second, the study contributes towards advancing research in this domain. These contributions are expanded upon below:

- Industrial level contributions:
  - The resulting holistic understanding enables relevant practitioners and policymakers to devise policies and support mechanisms that address environmental sustainability-related differences across different-sized firms. Specifically, large firms were found to show significantly greater levels of GSCP implementation than SMEs. Therefore, to promote sector-wide green supply chain practices implementation, large firms could help to transfer environmental knowledge, expertise, and skills to SMEs through the processes of initiation, persuasion, planning, adoption, and confirmation (Sarkis et al., 2011). Policymakers and industry groups could encourage such diffusion through programs, collaborative partnerships, and mentoring opportunities and/or by encouraging large firms in the supply chain to pressurize SMEs to implement GSCP.
  - Also, we found heterogeneity in the influence of external drivers on SMEs and large firms. This provides an opportunity for governments to leverage the external environmental drivers appropriately (as per firm size). In the UAE construction sector's case, for example, policymakers could decide on more stringent environmental regulations specific to large firms, since these firms

consider the current regulations to be less onerous to fulfil. They could also support and empower NGOs so that their pressure (on firms) for GSCP is enhanced universally or any imbalance in their pressure for large firms and SMEs is eliminated. Government and industry groups could also work towards increasing the environmental awareness levels of buyers/customers, so that they can impart related pressure on both SMEs and large firms, rather than large firms alone. On the other hand, the internal drive of firms to implement GSCP, whether it is a concern for the environment or to realize business benefits, was found to be greater for large firms than SMEs. Governments and industry groups must, therefore, strive to increase SMEs' awareness of their importance for a green economy and the business benefits they could realise from GSCP implementation. Also, government incentive programs could support and motivate SMEs to implement GSCP.

- The other key implication for policymakers is the relatively large influence of internal and external environmental barriers for SMEs (vis-à-vis large firms). Government and industry groups must, therefore, strive to support SMEs in particular in coping with these barriers; support mechanisms such as financial support, incentives, tax discount, training, and preferential treatment could be used. The findings on the actual performance benefits from GSCP implementation show that "being green pays" both in the short and the long run, especially for large firms. However, the findings show that SMEs are not too far behind large firms in any of the performance aspects (environmental, cost and organizational), which should, therefore, provide impetus to them to implement GSCP.

- Research level contributions:
  - This study is arguably the first comprehensive attempt to understand the influence of firm size on supply chain environmental sustainability. The findings also bring some degree of consensus to the limited and scattered nature of previous research on the subject. Also, many of the findings are novel in nature, such as the impact of firm size on external barriers.
  - Given that construction supply chain mirror a wide spectrum of different sectors and industries (DBIS, 2013), the finding to some extent can be generalized to other sectors as well.
  - Since the underlying attributes of construction sectors are similar across countries, the lessons learned from this study can be generalized to construction sectors in other countries, especially in emerging economies.

- Study limitations
  - However, more research is needed to enhance the generalizability of the findings, especially given that the results of this study are based on only one country and one sector.
  - First, the study only considered the impact of firm size. Other firm characteristics such as firm age, ownership could also influence the environmental sustainability of firms.
  - More research is needed to enhance the generalizability of the findings, especially given that the results of this study are based on only one country and one sector.
  - The use of perceptual measures because of the lack of availability of published performance data for environmental, economic, and organisational performance can be considered as a limitation. If the data becomes available, future research can focus on using actual and preferably more objective data on performance.

- Suggestions for future research

- Future studies could focus on multiple sectors and multiple countries.
- Studies should investigate the impact of firm ownership and/or firm age on environmental management separately, or could strive to capture the combined impact of firm size and ownership.
- Future studies could also consider the benefits of GSCP implementation on other performance dimensions such as social and operational performance.

Despite the limitations, this study provides excellent insights to policymakers, practitioners, industry groups and other concerned stakeholders to make informed actions, strategies and policy interventions so that all firms, regardless of their size, can participate/contribute to a green economy.

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Table 1: Classification of survey respondents

	Responses	Percentage
Size (employee nos.)		
SME (0-250)	216	47.5%
Large (>250)	239	52.5%
Total	**455**	**100%**
Stakeholder		
Developer	60	13.2%
Architects/Consultants	105	23.1%
Contractor	213	46.8%
Suppliers	77	16.9%
Total	**455**	**100%**
Respondents experience (in year) in the construction sector		
0-2	9	1.9%
3-5	69	15.2%
6-10	143	31.4%
>10	234	51.4%
Total	**455**	**100.0%**

Table 2. Demographic details about the interview respondents

Stakeholders	Interviewee Details	Developer	Architects/Consultants	Main Contractor	Subcontractor	Supplier
Large (All key stakeholder firms involved are large)	Annual Turnover	~$ 2.5 billion	~$ 550 million	~$ 900 million	~$ 450 million	~$ 1.8 billion
	Designation of Interviewee	•Head of projects •Director-Sustainability & Commissioning	•Vice President •Senior Architect	• Senior Project Manager • Head of Procurements • Senior Coordinator - Contracts	•Site Engineer •Project Manager	•Divisional Manager •Business Development Manager-MENA •Project Engineer
Small (All key stakeholder firms involved are SMEs)	Annual Turnover	~$ 325 million	~$ 35 million	~$ 80 million	~$ 45 million	~$ 18 million
	Designation of Interviewee	•Director-Residential Projects •Head of Operations	•Architect •Senior Architect	• Project Manager • Procurement Engineer	• Head of MEP Division	•Manager – Client Liaison

Table 3: Extents of implementation of external GSCP for SMEs and large firms

Hypothesis	External GSCP	Extent of implementation (Scale 1-5)		Difference in extent of implementation between SMEs & large firms (mean)	t-value	Hypothesis supported (Yes/No)
		For SMEs (mean)	For large firms (mean)			
H1a	Eco-design [a]	3.8	4.2	-0.4	-2.71**	Yes
H1b	Environmental purchasing [b]	3.5	4.0	-0.5	-4.53***	Yes
H1c	Environmental transportation	3.3	3.7	-0.4	-3.00**	Yes
H1d	Environmental manufacturing/construction [b, c]	3.8	4.3	-0.5	-3.47**	Yes
H1e	End of life environmental practices	3.2	3.7	-0.5	-3.25**	Yes
H1	**Overall external environmental practices [d]**	**3.5**	**3.9**	**-0.4**	**-4.27*** **	**Yes**

Scale: *1 means very low & 5 means very high level of implementation; ***significance at p<0.001; **significance at p<0.01; *significance at p<0.05*
[a]Not considered for Contracting firms; [b]Not considered for Architectural/Consulting firms; [c]Not considered for Developers; [d]Considering all external GSCP together

Table 4: Extents of implementation of internal GSCP for SMEs and large firms

Hypothesis	Internal GSCP	Extent of implementation (Scale 1-5)		Difference in extent of implementation between SMEs & large firms (mean)	t-value	Hypothesis supported (Yes/No)
		For SMEs (mean)	For large firms (mean)			
H2a	Environmental Management System (EMS) and ISO 14001	3.9	4.3	-0.4	-5.55***	Yes
H2b	Environmental training	3.8	4.2	-0.4	-5.08***	Yes
H2c	Environmental auditing	3.4	3.9	-0.5	-5.83***	Yes
H2d	Cross functional integration	3.8	3.9	-0.1	-1.06	No
H2e	Environment-related R&D	2.7	3.3	-0.6	-10.3***	Yes
H2	**Overall internal environmental practices [a]**	3.5	3.9	-0.4	-4.98***	Yes

Scale: *1 means very low & 5 means very high level of implementation; ***significance at p<0.001; **significance at p<0.01; *significance at p<0.05*
[a]Considering all internal GSCP together

Table 5. Strengths/influences of drivers of and barriers to implementation of GSCP for SMEs and large firms

Hypothesis	*External Environmental Drivers*	Strength/Influence (Scale 1-5)		Difference in strength/influence between SME's and large firms (mean)	t-value	Hypothesis supported (Yes/No)
		For SMEs (mean)	For large firms (mean)			
H3a	Government environmental regulation	3.5	2.9	0.6	7.81***	No
H3b	Stakeholder pressure (supply chain)	3.3	2.9	0.4	4.08***	Yes
H3c	NGO pressure	2.1	2.4	-0.3	-3.31***	Yes
H3d	Consumer pressure [a]	1.6	2.3	-0.7	-4.00***	Yes
H3e	Competitor pressure	3.0	2.9	0.1	1.62	No
	Internal Environmental Drivers					
H3f	Environmental commitment	3.3	3.9	-0.6	-7.49***	Yes
H3g	Business benefits	3.1	3.9	-0.8	-9.81***	Yes
	External Environmental Barriers					
H4a	Shortage of environmental professionals	3.4	2.8	0.6	6.38***	Yes
H4b	Shortage of local environmental/green suppliers	3.6	3.0	0.6	6.27***	Yes
	Internal Environmental Barriers					
H4c	High cost of implementation	4.1	3.4	0.7	6.60***	Yes
H4d	Lack of knowledge and awareness	3.6	2.9	0.7	7.02***	Yes

Scale: *1(very low strength/influence) - 5 (very high strength/influence); ***significance at p<0.001; **significance at p<0.01; *significance at p<0.05*

[a] *Only considered for Developer*

Table 6. Performance benefits (overall) from GSCP for SMEs and large firms

Hypotheses	Environmental performance benefit measure	Extent of benefit (Scale 1-5)		Difference in benefit between SME's and large firms (mean)	t-value	Hypothesis supported (Yes/No)
		For SMEs (mean)	For large firms (mean)			
H5	Environmental performance	3.5	3.8	-0.3	-3.33**	Yes
H6	Cost performance	3.1	3.4	-0.3	-3.20**	Yes
H7	Organizational performance	3.1	3.3	-0.2	-2.26**	Yes

Scale: *1 means a very low level of benefits and 5 means a very high level; ***significance at p<0.001; **significance at p<0.01; *significance at p<0.05.*

Appendix-1

Environmental Practices

Please rate the environmental practices implementation in your organization

[Strongly Agree (5), Agree (4), Neither Agree nor Disagree (3), Disagree (2), Strongly Disagree (1)]

Constructs and items (Literature Source)	Confirmatory factor loadings	Cronbach's alpha (α)
External Environmental Practices		
Environmental Design		
Environmental impact assessment of design is considered	0.80	0.89
Natural ventilation is considered in projects	0.66	
Natural lighting is considered in projects	0.80	
Waste water recycling is considered in projects	0.67	
Photo-voltaic panels is considered in projects	0.82	
Energy efficient lighting system is considered in projects	0.70	
Energy efficient heating and air conditioning systems is considered in projects	0.76	
Pre-fabricated components are considered in projects	0.60	
Materials with high re-cycled content and low embodied energy is considered in projects	0.89	
Non-hazardous materials are considered in projects	0.69	
Environmental Purchasing		
Environmental criteria(s) are included in material purchase decisions	0.91	0.86
Environmental criteria(s) are included in tendering	0.87	
Environmental Transportation		
Provision of accommodation to employees near project sites is provided	0.82	0.84
Use of video conferencing in place of face to face meetings is used	0.85	
Employees are encouraged to use shared transport and public transport	0.85	
Materials are transported in full truck load quantities	0.83	
Materials are transported in fuel efficient vehicles	0.89	
Environmental manufacturing/construction		
Provision for waste water recycling is available at project site	0.67	0.79
Pre-fabricated components are used at projects	0.72	
Materials with high re-cycled content and low embodied energy is used	0.84	
Non-hazardous materials are used in projects	0.74	
Comprehensive waste management plan is developed for project sites	0.80	
Automation is used for onsite construction activities	0.79	
Fuel efficient machinery is used	0.78	
End of life environmental practices		
Environmental impact is considered during end of life demolition and disposal	0.88	0.83
Material from the end of life demolished projects is recovered and recycled	0.93	
Internal Environmental Practices		
International environmental certifications such as ISO 14001 have been obtained	0.83	0.82
Training is provided to employees on environmental issues	0.85	
Projects are audited from an environmental perspective	0.66	
Cross functional teams are used when implementing environmental practices	0.94	

Research and development is conducted to improve environmental practices	0.88	

Environmental Drivers

Please rate the extent to which following factors have influenced your organization's drive to implement environmental practices

[Extremely high influence (5), High influence (4), Moderate Influence (3), Little Influence (2), No Influence (1)]

Constructs and items (Literature Source)	Confirmatory factor loadings	Cronbach's alpha (α)
External Environmental Drivers		
Government green-related regulations	0.86	0.78
Pressure from supply chain partners	0.80	
Pressure from buyers/end customers	0.90	
Pressure from Non-government organizations	0.84	
Pressure from competitors	0.86	
Internal Environmental Drivers		
Commitment to protecting the environment	0.86	0.73
To achieve business benefits	0.85	

Environmental Barriers

Please rate the extent to which each of the following factors have acted as a barrier/challenge in implementing environmental practices in your organization

Extremely high influence (5) High influence (4) Moderate Influence (3) Little Influence (2) No Influence (1)

Constructs and items (Literature Source)	Confirmatory factor loadings	Cronbach's alpha (α)
External Environmental Barriers		
Shortage of local environmental/green professionals	0.80	0.71
Shortage of local environmental/green suppliers	0.69	
Internal Environmental Barriers		
High cost of implementation	0.71	0.68
Lack of knowledge and awareness on environmental aspects	0.79	

Performance

Please indicate the extent of improvement in performance from implementing environmental practices in your organization.

Strongly Agree (5) Agree (4) Neither Agree nor Disagree (3) Disagree (2) Strongly Disagree (1)

Constructs and items (Literature Source)	Confirmatory Factor Loadings	Cronbach's alpha (α)
Environmental Performance		
Number of environmental accidents has declined	0.62	0.93
Greenhouse gas emissions have decreased	0.69	
Water consumption has decreased	0.76	
Energy consumption has decreased	0.77	
Landfill waste has decreased	0.77	
Material use has decreased	0.60	

Hazardous material use has decreased	0.66	
Cost Performance		
Energy expenses has decreased	0.67	0.89
Water expenses has decreased	0.53	
Material expenses has decreased	0.72	
Cost of managing waste has decreased	0.98	
Total environmental penalties and fines has decreased	0.94	
Organizational Performance		
More project orders are received	0.92	0.86
Orders are received at a higher price	0.83	
Market share among competitors has increased	0.89	
Return on investment has increased	0.97	

Appendix 2

Main Interview Questions

- What are the green practices implemented by your firm? And why?
- What are the specific external factors that is driving your firm to implement these green practices? And why?
- What motivates your firm internally to implementing these green practices? And why?
- What are the external barriers that is stopping your firm from implementing green practices? And why?
- What are the internal barriers that is stopping your firm from implement green practices in the sector? And why?
- Do you see any overall improvement in environmental performance, a while after the implementation of green practices? If so, how much? and why? (If not why?)
- Do you see any improvement in cost/economic performance, a while after the implementation of green practices? If so, how much? and why? (If not why?)
- Do you see or foresee any long-term improvement in organizational performance after the implementation of green practices? If so, to how much? and why? (If not why?)

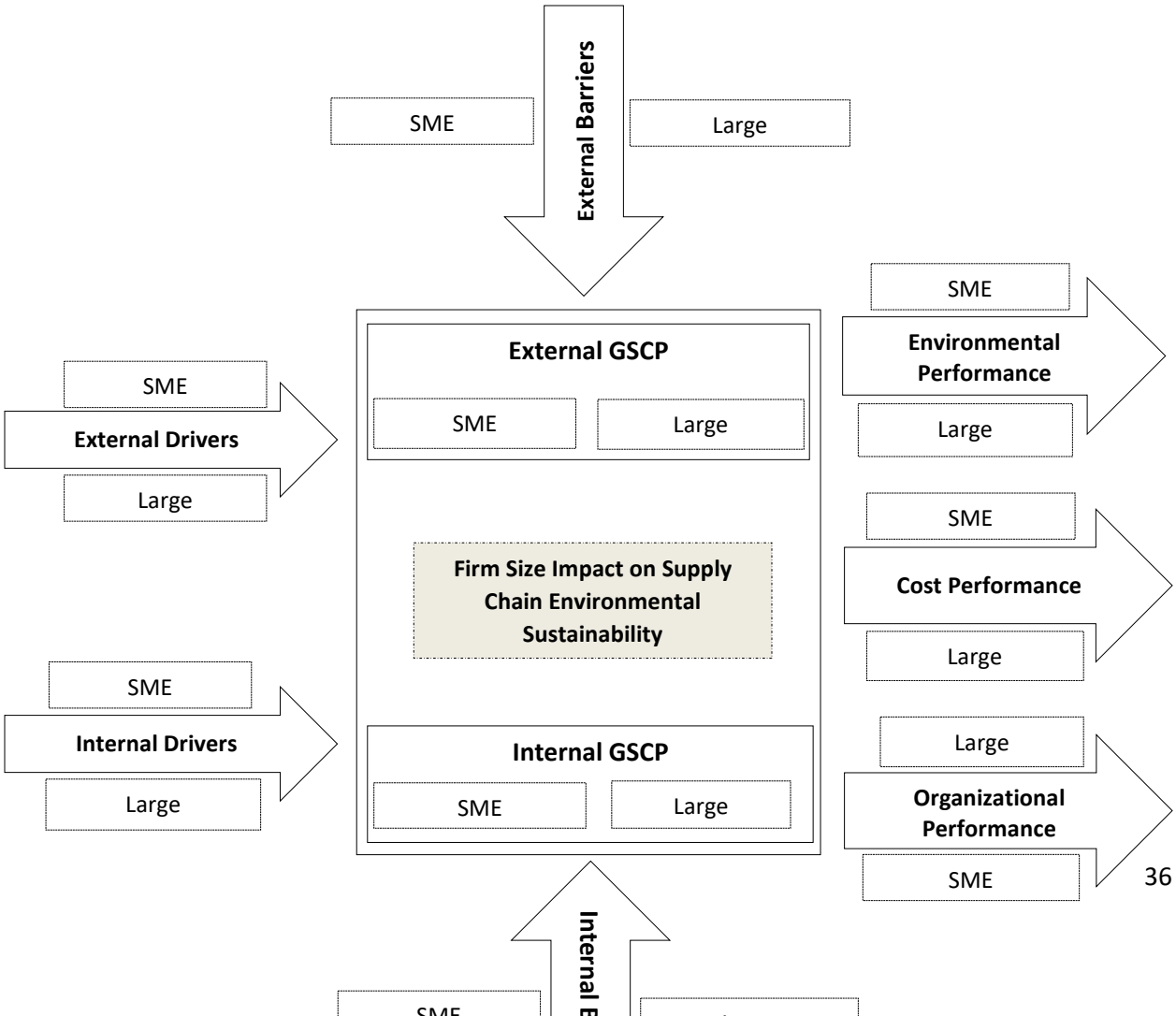
SME
External Barriers
Large
SME
Environmental Performance
Large
External GSCP
SME
Large
SME
External Drivers
Large
Firm Size Impact on Supply Chain Environmental Sustainability
SME
Cost Performance
Large
SME
Internal Drivers
Large
Internal GSCP
SME
Large
Large
Organizational Performance
SME
Internal Barriers

Figure 1. The framework of firm size impact on supply chain environmental sustainability