

Do firm characteristics affect environmental sustainability?: A literature review based assessment

Abstract

Combating environmental pollution and climate change mandates strong commitment and participation of all firms across sectors. However, the environmental conduct of firms is seen to vary as per their characteristics, especially their size, ownership, and age. Current understanding of these characteristics' influence on environmental sustainability is limited, fragmented, and scattered across the literature, which this study seeks to improve and contribute to. Based on a rigorous screening of the last 25 years' literature (1996-2020), the study develops a comprehensive understanding of firm characteristics' implications for environmental sustainability, namely, environmental practices implementation, environmental drivers, environmental barriers, and associated (environmental, cost/economic, operational, and organizational) performance implications. Several meaningful and generalizable trends, conflicts, and consensus, or lack thereof, are revealed. For instance, the extent of environmental practices' implementation can be seen to be greater at large firms' (vis-à-vis small ones) and at foreign firms' (vis-à-vis local ones), though not much difference is seen between old and new firms. Also, several meta-factors such as resources availability, innovation propensity, and bureaucracy and organizational inertia are identified, that explain the differential influence of firm characteristics on environmental sustainability, and dispel erroneous stereotypes. Finally, gaps in the literature offering avenues for future research are highlighted along with implications for research, theory and practice. Results are expected to help policymakers and practitioners develop policies/interventions that ensure all firms irrespective of their characteristics contribute to environmental sustainability. A comprehensive review of this kind has not been previously undertaken and constitutes the novelty of this work.

Keywords: Firm characteristics, size, age, ownership, environmental sustainability

1. Introduction

Environmental pollution and climate change are a significant challenge of the twenty-first century (UNEP, 2010). Global efforts to combat this challenge requires strong commitment and participation of all firms across sectors, and governments worldwide are encouraging/pressurizing them in this direction. However, not all firms take their environment-related obligations seriously, or even if they do, they are unable to generate the same level of environmental performance/sustainability as the others (Balasubramanian et al., 2020; Balasubramanian and Shukla, 2020). Could firm characteristics be a factor in their differential commitment/contribution on the environmental front?

Studies have shown firm characteristics, namely, size, ownership, and age, to be important contingency variables that affect an organization's environmental strategy, practices, and performance (Earnhart et al., 2014; Zhu et al., 2008; Vijayvargy et al., 2017; Shrivastava and Tamvada, 2019; Gil et al., 2001; Ashton et al., 2017). However, the current understanding of them is fragmented and scattered across the literature. Most studies have examined specific aspects, i.e., specific firm characteristics vis-a-vis specific

environmental aspects, such as firm age and environmental reporting practices by Haladu and Beri (2016), and firm ownership and environmental commitment by Faith et al. (2018). There is also a conflict in the findings in many cases: for example, both greater (e.g., Vijayvargy et al., 2017) and lower (e.g., King and Lenox, 2002) environmental performance benefit from environmental practices have been reported for large firms vis-à-vis small ones. To advance the knowledge on this subject, therefore, a comprehensive review that provides the current state of knowledge/understanding about it is necessary. Such a review should not only include all the relevant firm characteristics, but also all the key environmental sustainability dimensions, specifically environmental practices implementation, their associated drivers, barriers, and performance implications (Balasubramanian and Shukla, 2017a; 2017b). This forms the focus of this study whose aim is to i) Understand the current state of knowledge of each of the firm characteristic's influence on each of the environmental sustainability dimensions, and ii) Identify associated knowledge gaps and propose an agenda for future research.

The rest of the paper is structured as follows. In the next section, we discuss the methodology used for the systematic literature review. In section three, the findings pertaining to each of the firm characteristics' influence on each of the environmental sustainability dimensions are discussed. Key knowledge gaps and agenda for future research are covered in section four, while the final section discusses the conclusions and implications for research and practice.

2. Research Methodology

We first synthesized the key environmental sustainability dimensions from the literature, which are: environmental practices, environmental drivers, environmental barriers, and performance (Zhu et al., 2007; Walker et al., 2008; Vijayvargy et al., 2017; Sajjad et al., 2020; Balasubramanian et al., 2020; Balasubramanian and Shukla, 2020; Balon, 2020).

The central dimension of environmental sustainability is the efficient and effective implementation of 'environmental practices' or initiatives taken by a firm to minimize the negative environmental impacts of its activities (Gonzalez et al., 2008; Awaysheh and Klassen, 2010; Perotti et al., 2012). The key ones collated from the literature including the studies of Seuring and Muller (2008), Zhu et al. (2008), Malviya and Kant (2015), Balasubramanian and Shukla (2017a; 2017b) and Balon (2020) are: eco-design, environmental purchasing, environmental manufacturing/use of environmental technologies, environmental packaging, environmental transportation, waste management, end of life environmental practices, EMS (Environmental management system) and ISO 14001, environmental training, environmental auditing, environmental disclosure/reporting, and environmental-related research & development (R&D).

'Environmental drivers' and 'environmental barriers' are also important environmental sustainability dimensions given that affect the implementation of the aforementioned environmental practices. While environmental drivers are forces that coerce/motivate firms to implement environmental practices, environmental barriers are hindrances/challenges that prevent them from doing so. The key environmental drivers and which were identified from highly cited studies on the subject including the works of Seuring and Muller (2008), Walker et al. (2008), Walker and Jones (2012), Ben Brik et al. (2013), Balasubramanian and Shukla (2017a; 2017b) and Sajjad et al. (2020) include: environmental commitment,

business benefits, government environmental regulation, stakeholder pressure (supply chain), societal/NGO pressure, consumer pressure, and competitor pressure. On the other hand, key environmental barriers (of environmental practices) include high cost of implementation, lack of knowledge and awareness, shortage of environmental professionals, and a shortage of local environmentally friendly/green suppliers (Seuring and Muller, 2008; Balasubramanian and Shukla, 2017a; 2017b; Sajjad et al., 2020).

Finally, environmental sustainability has to be reconciled with the associated performance implications/impact/benefits (arising from implementing environmental practices), which therefore is another key dimension. This impact/benefit could be in terms of improved environmental performance (e.g., reductions in air emissions, material usage, and water consumption) (Zhu and Sarkis, 2004; Hervani et al., 2005; Zhu et al., 2007; Green Jr et al., 2012; Vijayvargy et al., 2017; Balon, 2020), and/or improved operational performance (e.g., increase in product quality, reduction in inventory, and reduction in lead time) (Vijayvargy et al., 2017; Younis et al., 2019; Younis and Sundarakani, 2020; Balon, 2020) and/or improved financial performance (Balon, 2020). The last could be short term in nature involving reduction in costs (e.g., reduction in material and energy costs (Zhu and Sarkis, 2004; Zhu et al., 2007; Green Jr et al., 2012; Vijayvargy et al., 2017) and/or long term (i.e., related to the organization as a whole) such as increases in sales and market (Rao and Holt, 2005; Green Jr et al., 2012; Lee et al., 2012; Ortas et al., 2014; Vijayvargy et al., 2017).

Figure 1 shows the conceptual framework of environmental sustainability used in this study for categorizing the findings of the literature review.

Figure 1

The next focus was to identify articles that have considered any of them together with any of the (influencing) firm characteristics, and to analyze their content. A systematic literature review process, as per Denyer and Tranfield (2009) was followed, which consisted of the following steps: Material collection, categorization, and synthesis.

2.1 Material (articles) Collection

Figure 2 shows the systematic literature search process followed. Scopus database is known to include an extensive collection of environmental-sustainability-management-related journals (Ahi and Searcy, 2015; Ansari and Kant, 2017), and was therefore considered for generating the initial list of articles. In order to ensure rigor and quality, only articles from peer-reviewed academic journals were considered. The year 1996 was considered as the base year as this was when the first articles on the subject appeared. A keyword-based search with the following combination of keywords was used: (Environmental practices) AND ("Firm size" or "Firm ownership" or "Firm age"); (Environmental drivers or Environmental enablers) AND ("Firm size" or "Firm ownership" or "Firm age"); (Environmental barriers or Environmental challenges) AND ("Firm size" or "Firm ownership" or "Firm age"); (Environmental performance) AND ("Firm size" or "Firm ownership" or "Firm age"). This generated a little over 1600 articles published in the English language.

Figure 2

The articles were then screened on the basis of their title and abstract, and only those with a primary focus on one or more of the environmental sustainability dimensions were shortlisted. Subsequently, different inclusion/exclusion criteria were applied to their content. Inclusion criteria applied included that articles should have covered at least one of the firm characteristics' (firm size, specifically large and small firms, firm ownership, specifically local and foreign firms and firm age, specifically newer or older firms) influence on at least one of the environmental sustainability dimensions discussed earlier. Studies on other firm characteristics such as firm location and family-owned, public/state-owned, and joint ventures (foreign-local or public-private) in relation to ownership were found to be quite limited and trivial, and were therefore excluded. Further, only empirical studies that used quantitative or mixed quantitative-qualitative approaches were considered as the influence of firm characteristics in these were objectively established (which ensured comparison of their findings). Finally, the references cited in the shortlisted articles were used to identify additional relevant ones to yield a total of 68 articles in the end.

2.2 Categorization of Articles

First we have categorized the 68 articles based on country of investigation (Table 1) and number of publications by year (Figure 3). With regards to country of investigation, as seen in the table, most studies appear to have taken a single-country focus with a large number set in the US and China; other countries (spread across different continents) have seen one/few investigations. In terms of number of publication across years, as seen in the figure, with the exception of 2008, we have not seen more than five empirical studies in a year. This reiterates the fact that studies on firm characteristics and environmental sustainability is limited.

Table 1

Figure 3

Next, as shown in Figure 4, we have categorized studies based on the environmental sustainability dimension/s and firm characteristic/s considered, and the sectoral focus.

Figure 4

As can be seen from the Figure 4, most studies have been quite selective from an environmental sustainability standpoint, choosing to focus on one or two dimensions (e.g., environmental practices or performance impact/benefit or environmental drivers/barriers) with few considering all the dimensions

together. This is true from a firm characteristics perspective as well with firm size, ownership, and age being mostly investigated individually rather than all together in a study. For firm size, the total number of employees was found to be used as the proxy in most cases vis-à-vis others such as annual turnover, total assets, or sales volume; for firm ownership, foreign and local, and for firm age, the number of years in operation (since incorporation) have been predominantly used. Foreign firms in this study refers to subsidiaries of foreign multinational enterprises (MNEs). Industry sector-wise, studies have focused on individual ones such as construction, automotive, and chemicals, though most have looked at the manufacturing sector as a whole or have considered multiple sectors (generic). Surveys, and those conducted by the researchers themselves was found to be the most common research methodology used, though some have used existing survey data sets as well (e.g., Eurobarometer survey by Shrivastava and Tamvada (2019) and the OECD survey by Darnall et al. (2010)); a small number of studies have used secondary panel data from government sources for their work.

2.3 Synthesis of articles

For detailed insights, the content of each of the 68 articles was analyzed, and the different firm characteristics' influence on the various dimensions of environmental sustainability (as discussed), understood. This (influence) is captured in a relative sense, i.e., whether it was greater/bigger (↑), lower/lesser (↓), or similar/equivalent (↔) for each of firm size (large firms versus small ones), firm ownership (foreign firms versus local ones) and firm age (old firms versus new ones) with blanks indicating that aspect was not studied. Specifically, for environmental practices, (↑) - implies greater; (↓) - lower; or (↔) - similar levels of environmental practices implementation at large firms vis-à-vis small ones; or at foreign firms vis-à-vis local ones; or at older firms vis-à-vis newer ones. Similarly, for drivers and barriers, (↑) - implies bigger; (↓) - lesser; or (↔) - equivalent driver or barrier for large firms vis-à-vis small ones; or for foreign firms vis-à-vis local ones; or for older firms vis-à-vis newer ones. Finally, for performance, (↑) - implies greater; (↓) - lower; or (↔) - similar performance benefit for large firms vis-à-vis small ones; or for foreign firms vis-à-vis local ones; or for older firms vis-à-vis newer ones

To ensure accuracy, this assessment (classification) was independently done by two researchers. However, in few instances (less than 5%) there was some discrepancies in the independent assessment of researchers. For these cases, researchers met and discussed these discrepancies and subsequently agreed on the classification.

The extent of the explanation/justification provided, and also the actual explanations themselves (that could be collated/synthesized across studies to obtain deeper/more holistic insights) were recorded. By doing so, meta-factors that explain the heterogeneity in the environmental conduct of firms with different characteristics were identified and presented through a separate table (Table 6).

3 Findings

3.1 Firm characteristics' influence on environmental practices' (extent of) implementation

Each of the firm characteristics' influence on the extent of implementation of each environmental practice at an individual level (as covered in the study) was recorded along with an estimate of the extent of the associated explanation/justification provided. This is presented in Table 2.

As can be seen from the table, only one/few environmental practices are considered in most studies, though there are a few studies with five or more practices covered (e.g., Lewis and Cassells, 2010; Jabbour et al., 2016); however, none has considered all the practices. Certain practices such as environmental purchasing and environmental manufacturing/use of environmental technologies appear to have garnered more interest, while some others, such as environmental transportation and environment-related R&D, only a limited one.

With regards to a firm characteristic's influence on environmental practices' (extent of implementation), this is seen to vary across practices in many cases. For example, in Andonova (2003), large firms were found to implement environmental audit and ISO 14001 to a greater extent (than small firms), but no difference in implementation extent between the (large and small) firms was seen on environmental technologies.

The findings on a firm characteristics' influence on an environmental practice also appear to differ across studies: for example, with regards to firm size, large firms have been found to implement environmental design or eco-design to a lesser extent (Zhu et al., 2007), to a greater extent (e.g., Eltayeb and Zailani, 2009; Vijayvargy et al., 2017), and the same extent (e.g., Gonzalez et al., 2008; Zhu et al., 2008) vis-a-vis small firms in different studies. This can be seen for firm ownership and age as well. Overall though (ignoring some contradictions/inconsistencies), the extent of environmental practices' implementation can be seen to be greater at large firms' (vis-à-vis small ones) and at foreign firms' (vis-à-vis local ones), though not much difference in implementation is seen between the old and new firms. Explanation/justification wise though, only a few studies have provided detailed or even moderate level explanations, and most are quite superficial.

Table 2

3.2 Firm characteristics' influence on environmental drivers' (strengths)

This is captured in Table 3 for individual firm characteristics and at an individual environmental driver level. Looking at the table, it is clear that similar to for environmental practices, researchers have been selective in their coverage of environmental drivers: most have covered one/select few, some have considered five or more (e.g., Darnall et al., 2010; Lewis and Cassells, 2010), and none has covered all. While environmental commitment and government environmental regulations have been investigated more, focus on societal/NGO pressure, consumer pressure, and competitor pressure has been limited. Also, many studies that, for a firm characteristic, have covered multiple drivers, have reported the strengths/influences of these drivers to be different: for instance, in Aldrugi and Abdo's (2014) case, with regards to firm ownership, business benefits and governmental environmental regulations' strength/influence (as a driver) is greater for foreign firms, though societal pressure's strength/influence is the same for foreign and local firms. And finally, again similar to for environmental practices, for a particular firm characteristic and driver, the findings appear to vary across studies. For example, with regards to firm size, studies have reported government environmental regulations to be a bigger driver for large firms (e.g., Baylis et al., 1998; Serpell et al., 2013), a smaller driver for large firms (e.g., King and Lenox, 2001) and a similar level of driver for large firms vis-à-vis small ones (Lewis and Cassells, 2010;

Tatoglu et al., 2014). Overall, previous studies do not appear to definitively establish the nature of firm characteristic's (size, ownership, and age's) influence on the strengths of the different environmental drivers. The associated explanation/justification provided is also quite limited.

Table 3

3.3 Firm characteristics' influence on environmental barriers

Similar to environmental drivers, firm characteristics' influence on environmental barriers is presented in Table 4. As can be seen from the table, firm size is the only firm characteristic considered, and that too only by a few authors. Also, though multiple barriers are considered, all are not considered in any one study. There is some inconsistency in the findings if we go down from top to bottom in the table, i.e., firm size's strength/influence for an environmental barrier across different studies. Differential firm size influence for different barriers is also seen if we go from left to right in a row of the table; for example, in Lewis et al.'s (2015) case, high cost of implementation is an equivalent barrier, lack of knowledge and awareness is a lesser barrier, and lack of green professionals is a bigger barrier for large firms vis-à-vis small ones. Finally, no study has provided a detailed explanation/justification for their findings.

Table 4

3.4 Firm characteristics' influence on performance impacts/benefits (from environmental practices)

Firm characteristics' influence on performance impacts/benefits (from environmental practices) is captured (refer Table 5) in terms of the extent of those benefits (whether it was greater/lower/equivalent for large or small, foreign or local and old or new firms). The performance measures considered, and the explanation/justification provided for the findings are also covered.

The table reveals a lack of consistency in the number as well as the nature of the performance measures considered. For each of the environmental, cost, operational, and organizational performance, the number of measures considered varies from one to five; in the case of operational performance, though, the authors have used more than five measures. A wide variety of measures have been used for each kind of performance except the organizational one.

Table 5

In environmental performance's case, the most used ones are reductions in air emissions, water pollution, water usage, energy/electricity usage, waste generated (solid and water waste), consumption of hazardous/toxic materials, and frequency of environmental accidents; the unique ones include noise and

light pollution control, environmental rating, environmental protection record, environmental responsibility score, land-use efficiency, and scrap rate. With regards to cost performance measures, reductions in costs of materials, water and energy, waste treatment, and reduction in fines from environmental-related accidents are the most common ones. For operational performance, these are increase in product quality, reduction in lead time, increase in new product lines, and improvement in capacity utilization. Finally, for organizational performance, except for a few unique measures such as increases in customer satisfaction, client base, innovation, and corporate identity, there is a greater consensus on the measures used, which are increases in earnings/sales, profit, profit growth, market share, return on investment, and improvement in corporate image/reputation.

With regards to the nature of the investigations, it can be noted from the table, that no study barring Pargal and Wheeler (1996) has considered all three firm characteristics (of size, ownership, and age) in their work. On the other side, from the performance impact/benefit perspective, the focus of most studies, including Pargal and Wheeler (1996) has been on environmental performance impact/benefit; other performance impacts/benefits have seen limited consideration with just two studies considering all four performance impacts/benefits.

In terms of consistency of findings, for a study and a certain firm characteristic, the different performance impacts/benefits considered mostly show a similar pattern; for example, in the case of Vijayvargy et al. (2017) who investigated firm size implications on environmental, cost/economic and operational performance benefits (from environmental practices), all the three benefits were greater for large firms (vis-à-vis small ones). On the other hand, findings for the same firm characteristic and same performance impact/benefit across studies, show some inconsistency. For instance, with regards to firm size and environmental performance/benefit, studies have reported greater benefit (King and Lenox, 2001; Vijayvargy et al., 2017), lower benefit (Grant et al., 2002; King and Lenox, 2002) and similar level of benefit (Theyel, 2000; Lewis and Cassells, 2010) for large firms vis-à-vis small ones. This (inconsistency) can also be seen for the other firm characteristics and performance impacts/benefits investigated. Overall, therefore, there is insufficient clarity on this subject which is also not helped by the lack of detailed explanation/justification on the findings in most studies.

3.5 Meta-factors to explain the differential impact of firm characteristics on environmental sustainability dimensions

Our goal now is to explain the reported findings on firm characteristics' influence on environmental sustainability dimensions. We attempt to do so through some factors that we have conceptualized through thematic analysis of the justifications/explanations provided in these studies; these are referred to as meta-factors because their explanatory power covers all firm characteristics and environmental sustainability dimensions. Table 6 presents our ten meta-factors, where each can be seen to be associated with all three firm characteristics; depending on greater or lower correspondence with a characteristic, relevant firms could be positively or negatively influenced on the environmental sustainability dimensions (or their environmental conduct). This is why we have characterizations of greater and positive influence and/or greater and negative influence and/or lower and positive influence and/or lower and negative influence (as relevant) under individual firm characteristic categories. For example, on the first meta-factor of 'resources availability', for large firms, we have one set of studies under the title 'greater and

positive influence' as well as another set with the title 'greater and negative'. What the first indicates is that large firms have greater resources and which is positive from an environmental sustainability perspective as it allows them to invest in environmentally-friendly equipment and machinery and on environmentally knowledgeable manpower; the second on the other hand indicates that large firms have positive resources but which can be negative if they use those resources for environmental lobbying and fighting environmental regulations. The same way for the other cells in the table. Given that vis-à-vis a meta-factor, some studies can be from the perspective of large firms, while others, from a small firm one, the nature of representation in Table 6 ensures both to be separately identified; similarly for foreign and local firms and old and new ones. The blank cells in the table imply a lack of understanding/research gaps. We now discuss each of the meta-factors individually.

Table 6

3.5.1 Resources availability

Large firms' greater financial (e.g., Gonzalez et al., 2008) and human (e.g., Tambunlertchai et al., 2013) resources were found to positively influence their environmental practices' implementation (e.g., Henri and Journeault, 2008; Singh et al., 2015). For example, greater availability of manpower and capital allows large firms to invest in pollution prevention systems and procure environmentally-friendly equipment and machinery (e.g., Younis and Sundarakani, 2020). On the contrary, resource scarcity with regards to capital (e.g., Vijayvargy et al., 2017), human resources (e.g., Zhu and Geng, 2013), and technology (Chang et al., 2018) have been found to hinder environmental practices implementation at small firms. However, as seen in the table, a few studies have shown that the greater resource availability of large firms is not necessarily environmentally positive; it can have a negative influence, such as when these firms use their large/slack resources to build corporate buffers to fight environmental improvements (Firestone, 2002), or for environmental lobbying and litigation to avoid the repercussions of environmental misconduct (Grant et al., 2002; Darnall et al., 2010). Conversely, lack of slack resources could have an environmentally positive influence on small firms. They would be less likely to invest their limited resources in environment-related political resistance, and instead use it to address the environmental concerns of stakeholders (Darnall et al., 2010); also because they would be eligible to receive government and other industry stakeholders' technical and financial support, including environment-related ones (Sarkis and Dijkshoorn, 2007; Lee, 2008).

With regards to foreign firms, Zhu et al. (2012) reported that these firms have a resource advantage as they receive financial, human and technological support to pursue environmental programs from their parent headquarters; also, that because of this advantage, such firms are likely to demonstrate greater environmental sustainability than the local ones. However, this is based on the study of foreign firms from developed countries. It is still unclear from the literature on whether foreign firms from developing countries will have the same resource advantage enjoyed by foreign firms from developed countries.

Newer firms were found to have a resource advantage (and consequently advantage on the environmental front) because of their more modern assets, such as the latest environmental technologies

and energy-efficient manufacturing/production equipment (Elsayed, 2006; Tatoglu et al., 2014). They generally incorporate/install these technologies and equipment during the plant construction stage itself when it is cheaper to do so (Pargal and Wheeler, 1996; Ashton et al., 2017; Singh et al., 2015). Older firms, on the other hand, use less up-to-date environment-related equipment and technologies, which they are also unwilling to upgrade because of the cost and risks in the retrofitting process (Darnall et al., 2010).

3.5.2 Technical and managerial know-how

Large firms possess greater technical and managerial know-how on the environmental front, which gives them a significant competitive advantage (Elsayed, 2006; Gonzalez et al., 2008). Small firms generally lack this know-how (Sarkis and Dijkshoorn, 2007; Lee, 2008); they also consider their environmental impacts to be small/insignificant (that do not require any remedial environment-related initiatives/interventions). In fact, many small firms do not recognize the potential 'win-win' from environment-related activities (Lewis and Cassells, 2010).

Foreign firms were found to possess greater technical and managerial know-how, including environment-related, because of their international exposure and experience (Albornoz et al., 2009; Zhu et al., 2012). They also make concerted efforts to acquire know-how from their headquarters (Christmann and Taylor, 2001; Zhu et al., 2012), something which is not possible for local firms. With regards to knowledge of the local business environment, though, foreign firms are comparatively disadvantaged; for example, waste management requires local skills, such as the ability to negotiate arrangements with local buyers to turn waste into saleable byproducts (King and Shaver, 2001).

Older firms were found to possess greater technical and managerial know-how; this is because environmental know-how tends to accumulate over time with associated routines gradually becoming a part of the operations (Welbeck et al., 2017). It makes older firms more competitive than newer ones (Younis and Sundarakani, 2020). For example, with regards to environmental management systems, the longer a facility operates under such systems, the greater is the realized environmental performance improvement; this is on account of keeping up-to-date with current and future industry trends (Welbeck et al., 2017), as also the acquired knowledge and competencies (Russo, 2009).

3.5.3 Innovation propensity

Some large firms are innovative because they have extra resources to invest in research and development; this gives them the luxury to experiment with different environmental initiatives such as source reduction, pollution prevention, and green product designs (Grant et al., 2002). For other large firms, environmental innovation is less because of their rigid and bureaucratic structure, which restrains the adoption of less familiar environmental practices/technologies, and/or those that could disrupt the status quo (Grant et al., 2002). On the other hand, smaller firms have an advantage because of their less bureaucratic structure; they possess a greater ability to innovate and to address the environmental concerns of stakeholders in ways that larger firms cannot (Aragón-Correa et al., 2008; Darnall et al., 2010). In the case of foreign firms, though, the evidence on this is limited; it shows their environmental innovation to be greater (than local firms) because of close communication, coordination, and knowledge transfer between the subsidiary and headquarter locations (Qi et al., 2011).

3.5.4 Visibility

Evidence from the literature shows that because of their greater visibility, large firms are exposed to significant environment-related pressures. This includes pressure from other firms in the supply chain (Baylis et al., 1998), the general public (Elsayed, 2006), environmentalists and regulators (Henri and Journeault, 2008; Tambunlertchai et al., 2013), and investors and other financial stakeholders (Cormier et al., 2005). This pressure was found to positively influence their environmental conduct. In contrast, smaller firms' lack of visibility has a negative influence: their large numbers make them too onerous for regulators, environmentalists, and other supply chain stakeholders to track, and because of which, they face less environment-related pressure from these entities (Baylis et al., 1998); they are also less scrutinized by the general public (Lewis and Cassells, 2010). Lesser pressure means lesser incentive to implement environmental practices or make associated performance improvements for these firms, and hence environmentally negative for them.

Foreign firms are more visible because of the greater international visibility of their parent firms; as a result, they face greater pressure from regulators, environmentalists, and other concerned stakeholders (Zhu et al., 2012; Tambunlertchai et al., 2013), and are consequently expected to do more on the environment front than local firms (Tatoglu et al., 2014).

3.5.5 Reputation and image

Large firms' greater need (vis-à-vis small firms) to maintain a good reputation and image has a positive environmental influence on them. Large firms generally have a large customer base; maintaining good environmental reputation and image among them as well as in the eyes of the general public is, therefore, necessary for success (Tambunlertchai et al., 2013, Tatoglu et al., 2014). This is also because large firms are more susceptible to environmental misconduct-related reputational damage as they receive greater attention from environmental organizations and the media (Chang et al., 2018). However, some authors argue that good environmental reputation and image are equally important for small firms because their survival depends on ensuring business continuity with their smaller customer base while seeking/getting new ones (Darnall et al., 2010).

Foreign firms were found to demonstrate greater environmental conduct at all of their subsidiary locations because any adverse publicity on an environment-related event there, or at headquarters, could easily spill-over to other locations; they are therefore very sensitive about their environmental image (Pargal and Wheeler, 1996; Zhu et al., 2012). They participate in voluntary environmental programs to build their reputation, goodwill, and image among local stakeholders and try to reduce their liabilities of foreignness in the host countries (Christmann and Taylor, 2001; Tambunlertchai et al., 2013; Tatoglu et al., 2014).

3.5.6 Preferential/ Discriminatory treatment

Small firms usually get preferential treatment in the form of subsidies (Aragon-Correa et al., 2008), incentives (Ashton et al., 2017), tax-cuts (Lee, 2008), and technical and financial assistance from the government (Aragon-Correa et al., 2008; Ashton et al., 2017), which has been found to be environmentally positive for them. However, some such preferential treatments can be environmentally negative as well; for example, the US government's Small Business Regulatory Enforcement Fairness Act which provides

special treatment for small firms and exempts them from implementing environmental practices (Grant et al., 2002).

Large firms, on the other hand, were found to face greater discriminatory treatment from stakeholders. Such firms are generally a government and environmental NGOs' primary target on implementing environmental practices (Qi et al., 2010); regulatory bodies are also known to award the stiffest environmental fines to such firms because of their ability to absorb them (Grant et al., 2002); finally, these firms are also more likely (than small firms) to get negative media coverage for an environmental mishap/misconduct (Grant et al., 2002). All of this has a positive environmental influence on these (large) firms.

Still, some studies have reported that regulators and environmental groups on many occasions ignore the environmental transgressions of large firms because of the potential for lengthy litigation and the associated (greater) costs and complications; this, in turn, is because large firms tend to use their corporate buffers for litigation (Firestone, 2002; Darnall et al., 2010). In contrast, the environmental wrongdoings of smaller firms are pursued more as they are less likely to be challenged; as per Firestone (2002), small firms in the US are seven times more likely to be subject to environmental penalties than their larger counterparts.

The preferential treatment received by foreign firms in their host countries was found to negatively impact their environmental conduct. For instance, in accordance with the pollution haven hypothesis, some host countries are willing to provide lax environmental standards as an incentive to attract foreign firms and encourage their relocation from countries with stricter environmental policies (King and Shaver, 2001; Eskeland and Harrison, 2003; Liang, 2014). Also, foreign firms, especially in poor countries, were found to lobby governments to maintain lax standards and avoid pollution abatement costs (Andonova, 2003; Tatoglu et al., 2014). On the other hand, the discriminatory treatment received by foreign firms, especially in developing countries with stringent environmental regulations, was found to have a positive environmental influence on them. Studies have shown that foreign firms are more often investigated, audited, and prosecuted for environmental misconduct than their domestic counterparts (King and Shaver, 2001); they also face greater penalties for environmental damage (Pargal and Wheeler, 1996) as well as have more environmental complaints filed against them by host country consumers, governments, and suppliers (Zhu et al., 2012).

3.5.7 Bureaucracy and organizational Inertia

The bureaucratic management style of large firms was found to have a positive environmental influence on these firms (Gil et al., 2001; Elsayed, 2006). Large firms tend to have a more administratively oriented control strategy, which means more structured activities, more formalized communication, and greater use of standardized information for evaluating environmental aspects, and as a part of organizational routines (Henri and Journeault, 2008). On the other hand, the less formal structure of small firms could mean the ownership, control, and operations being in the hands of an individual or a small group of individuals who have no/limited concern for the environment, thereby negatively impacting their environmental conduct (Wang et al., 2018).

However, the greater rigidity and organizational inertia of large firms in the form of standard operating processes could stifle new environmental initiatives (King and Shaver, 2001; Darnall et al., 2010). In contrast, smaller firms generally have less bureaucracy; they have greater structural flexibility, responsiveness, and simpler decision-making processes that enable them to make faster decisions and respond quicker to the environmental concerns of stakeholders (Lewis and Cassells, 2010; Darnall et al., 2010). Small size also facilitates greater internal coordination and closer interaction and communication between the employees and the owner–manager in addressing environmental issues (Aragón-Correa et al., 2008; Darnall et al., 2010). In addition, the better personal links, shared understanding, stronger identity, and unified culture have also been found to positively influence the environmental conduct of small firms (Aragón-Correa et al., 2008).

The bureaucratic management style of foreign firms has a positive environmental influence on them. These firms generally have similar organizational structures, functioning, and environmental decision making as their (environmentally advanced) parent organizations (Welbeck et al., 2017; Tambunlertchai et al., 2013).

In the case of older firms, they suffer from organizational inertia with regards to modifying their extant routines; they are therefore less willing to enhance their environmental practices such as introducing new energy-efficient manufacturing processes and machinery (Gil et al., 2001). Newer firms are less constrained in this regard, and therefore in a better position to address the environmental issues (Elsayed, 2006).

3.5.8 Economies of scale

Evidence from the literature shows economies of scale to have a positive influence on the environmental conduct of large firms. It allows large firms to recover environment-related investments through accrued benefits from waste prevention as well as the reuse, recycling, and valuation of waste (Gil et al., 2001; Min and Galle, 2001; Elsayed, 2006). Also, larger purchasing volumes gives these firms greater negotiation leverage and therefore better terms with green material suppliers whose usage therefore increases (Younis and Sundarakani, 2020); On the other hand, the lower quantities of reused and recycled materials may not provide small firms with adequate scale economies to justify investments in related environmental practices (Zhu et al., 2008).

3.5.9 Corporate environmental commitment

A firm's environment-related commitment was found to positively influence its environmental conduct. Such a commitment has been observed in both large (Brammer and Pavelin, 2008; Eltayeb and Zailani, 2009) and small firms (Baylis et al., 1998). For large firms, this commitment is demonstrated by the decisions of top management, which are then communicated through the organization's environmental vision and mission statements and environmental policies. In contrast, in the case of small firms, their environmental commitment is often linked to the personality of their owner-managers, which manifests itself in company actions.

Foreign firms' greater environmental commitment is often due to the environmental vision and mission of their parent companies, which is inherited at the subsidiary locations (Zhu et al., 2012). However, those foreign firms, that have moved to the host country in line with pollution haven hypothesis are likely to

demonstrate lower environmental commitment (Henriques and Sadorsky, 2006), and employ inferior technologies and practices than those in their home countries (Tambunlertchai et al., 2013). On the other hand, local firms may demonstrate greater environmental commitment, which is triggered by moral and ethical considerations that are consistent with the local cultural expectations (Kuada and Hinson, 2012).

3.5.10 Legitimacy seeking behavior

Firms, both large and small, were found to undertake environmental initiatives to enhance their legitimacy. While large firms generally try to enhance their legitimacy in the eyes of the regulators (Cormier et al., 2005; Elsayed, 2006), smaller firms seek to comply with the environmental requirements of their larger partners in the supply chain to sustain their business relationships (Gonzalez et al., 2008).

Foreign firms were also found to increase their environmental conduct to secure goodwill and enhance their legitimacy in the eyes of the regulatory authorities in their host country (Darnall et al., 2010). Often, foreign firms make an effort to go beyond their legal obligations to avoid liability of foreignness (Kuada and Hinson, 2012; Zhu et al., 2012).

Firms, both old and new were found to engage in environmental conduct to legitimize their existence, though this need for legitimacy was found to be greater among newer firms as they seek to develop a positive perception about their business (Tatoglu et al., 2014; Welbeck et al., 2017).

4 Research Gaps and Future Research Agenda

Based on the review and synthesis of the literature, several key gaps and opportunities for future research were identified that are discussed below.

4.1 Lack of holistic orientation

Except for a few studies that have considered all three firm characteristics (of size, ownership, and age), most were found to have considered only one or two characteristics (and predominantly firm size) in their investigations. Firm age, in particular, has seen considerably less research. Even studies that have explored multiple firm characteristics have not investigated from the perspective of these characteristics being correlated with each other (e.g., foreign firms could be large and also new age-wise). Considering all the characteristics in the same study, where their mutual relationships are thereby considered, would, therefore, enable a more holistic understanding of how their combined interaction influences the environmental sustainability of firms.

A similar gap is evident on the environmental sustainability dimensions: most studies have explored firm characteristics' influence on only one or two dimensions of environmental sustainability (specifically environmental practices implementation and performance impact/benefit from them), with environmental drivers and barriers seeing less interest. The dimensions are actually interrelated with each other: the opposing pressures of environmental drivers and barriers determine whether environmental practices get implemented and their extent of implementation, which in turn determines the performance impact/benefit realized from them. Considering all of them together when investigating firm characteristics' influence on them can, therefore, provide more holistic (and therefore better) insights that are lacking at the moment.

The holistic orientation is also missing when we consider sub-dimensions within each environmental sustainability dimension, e.g., individual environmental practices in the case of environmental practices or individual environmental drivers with regards to environmental drivers. Studies appear to have focused on select sub-dimensions (and which are different across studies), with none covering all key ones. In the process, some are insufficiently investigated: these include environmental transportation and environment-related R&D (for environmental practices), societal/NGO, consumer and competitor pressures (for environmental drivers), lack of green suppliers (for environmental barriers) and cost/economic, operational and organizational (for performance impact/benefits). The individual sub-dimensions are also inter-related with each other; for example, in the case of environmental practices, the individual practices of environmental training, auditing, and environment-related R&D are known to facilitate other practices such as eco-design, environmental manufacturing, and environmental transportation; similarly, in the case of performance impact/benefit, the environmental, operational, cost-economic and organizational impacts/benefits may be correlated/conflicted with each other, with this being true for the individual environmental drivers and barriers as well. Therefore, including all the relevant sub-dimensions of environmental practices/drivers/barriers/performance in the same study would enable a more precise understanding of firm size/ownership/age's influence on each at an individual level.

4.2 Lack of rigor

Understanding firm characteristics' impact on environmental sustainability was found to be the primary/sole focus in only a few studies: for example, Baylis et al. (1998), Grant et al. (2002), Elsayed (2006), Darnall et al. (2010), Zhu et al. (2008) and Vijayvargy et al. (2017) with regards to firm size, Faith et al. (2018) with regards to firm ownership and Younis and Sundarakani (2020) with regards to firm age. Most studies have explored this question as an auxiliary one. This is reflected in the lack of detailed explanation/rationalization of the findings, including through theories, where some well-known ones have only been applied (for example Resource-based view by Gonzalez et al., 2008 and Zhu et al., 2008; Institutional theory by Zhu et al., 2012 and Younis and Sundarakani, 2020), and in select studies only. Future studies should, therefore, take up this subject of firm characteristics and environmental sustainability as the primary one, where they can consider using established organizational theories such as stakeholder theory, complexity theory, strategic choice theory, transaction cost economics, diffusion of innovation theory, structuration theory, legitimacy theory and social embeddedness theory among others for explanation and understanding (Sarkis et al., 2011; Balasubramanian and Shukla, 2018); here they can also draw upon the learnings from other related domains such as corporate social responsibility and sustainable development Al-Gamrh and Al-Dhamari, 2016; Soytaş and Atik, 2018).

Next, in terms of methodological rigor, with the exception of very few studies (Baylis et al., 1998; Zhu et al., 2007), none of the others were found to have used a sequential mixed method approach (i.e., quantitative-qualitative) to develop a deeper understanding of 'how' and 'why' different firm characteristics affect the dimensions and sub-dimensions of environmental sustainability the way they do. Future studies can, therefore, combine a quantitative investigation with a subsequent qualitative one to seek more clarity and provided more substantive explanations/justification on the findings.

4.3 Lack of focus on polluting industries and countries

It was evident from the review that most studies have either been on specific sectors such as manufacturing or have considered multiple sectors in their investigations. The lack of focused studies on key polluting sectors is, therefore, surprising. For example, the transportation and logistics sector, with its significant carbon emissions, has been completely overlooked, while the potentially hazardous chemicals and pharmaceuticals sector has seen only a few investigations. This is true for other polluting sectors such as oil and gas, agricultural and food products, energy, and mining as well. From a country perspective too, though China and US, the top two polluting countries have seen the greatest interest, other major polluting countries such as India, Russia, Japan, and Germany have either seen limited or no research interest. Future studies should, therefore, focus on such less investigated and high polluting sectors and countries.

4.4 Lack of consistency in the measures, variables, techniques, and findings

There is a clear lack of consistency in the measures used to define firm characteristics, especially for firm size, as well as the measures used to assess environmental sustainability dimensions, particularly the different performance benefits. With regards to the latter, while some studies have used objective approaches (e.g., secondary panel data for water pollution), others have used perceptual ones (e.g., opinions of sample respondents through a survey). Such differences across studies could adversely impact the comparability and generalizability of their findings. Future studies should, therefore, explore using a consistent set of measures for firm size as well as for the environmental sustainability dimensions, particularly performance-related.

With regards to the survey method (that has been used by a large number of studies), a lot of variabilities is seen in the way firm characteristics' variables are considered in the statistical analysis of the survey data; they have been considered as an independent (explanatory) variable (e.g., Gil et al., 2001; Grant et al., 2002), a control variable (e.g., Christmann and Taylor, 2001; Cormier et al., 2005) or a moderating variable (e.g., Darnall et al., 2010; Wang et al., 2018). Further, a variety of different statistical techniques have been used. For instance, studies have used different kinds of regression analysis (e.g., Christmann, 2000; Gil et al., 2001; Ben Brik et al., 2013), correlation analysis (e.g., Theyel, 2000; Henri and Journeault, 2008), ANOVA (e.g., Eltayeb and Zailani, 2009; Kuada and Hinson, 2012); t-test (e.g., Zhu et al., 2008; Vijayvargy et al., 2017), descriptive and chi-square analysis (e.g., Baylis et al., 1998; Turk, 2009), and structural equation modeling (e.g., Branzei et al., 2004; Aragon-Correa et al., 2008) for the analysis. This variability in the nature of the statistical analysis further hinders the generalizability and transferability of the findings across studies.

The inconsistencies in the findings of different researchers (which were reported both across and within their studies in Tables 2 to 5) on firm characteristic's influence on the environmental sustainability dimensions could be on account of their use of different measures, variables, and techniques (though some could also be explained through the meta-factors discussed previously). Future studies should, therefore, strive for more procedural consistency that could help in establishing the "real truth" on how each of the firm characteristics influences each of the environmental sustainability dimensions and sub-dimensions.

4.5 Lack of understanding of environmental behavior of foreign firms from developing countries operating in developed countries

It was evident from the review of the studies that examined firm ownership impact on environmental sustainability that foreign firms considered are MNEs from developed countries operating in developing countries such as China or developed countries such as US. Unfortunately, we have not come across any research that examined the environmental behavior of foreign firms from developing countries operating in a developed country. Given the considerable number of foreign firms from developing countries operating in developed countries, a significant research gap exists in understanding the environmental behavior of foreign firms from developing countries. With increasing internalization of firms, this understanding is essential for developed country governments from a foreign direct investment perspective, i.e., whether to allow or block foreign firms developing country to enter their country as well as subject them to more scrutiny from an environmental stand point.

Based on the above research gaps, we also propose the following research questions as immediate 'call for research':

1. How and to what extend does firm characteristics interaction with each other influence environmental sustainability of firms? (e.g., environmental sustainability of a newly established but small foreign subsidiary vs long- established large foreign subsidiary)
2. Do firm characteristics impact on environmental sustainability of firms differ across sectors?
3. How do foreign firms from developing countries compare with local firms and with foreign firms from developed countries with regards to environmental sustainability? (e.g., environmental sustainability of Chinese or Indian multinational firms in US)

5 Conclusions

This study explored more than two decades of quantitative-oriented research on firm characteristics' impact on environmental sustainability that has not been previously attempted. It offers considerable evidence from the scattered previous literature that firm characteristics are an important aspect vis-à-vis environmental sustainability, and can, to a great extent, explain the differences in the environmental conduct of firms. For example, firm characteristics can explain why some firms self-regulate to go beyond compliance, while others move their operations to a location with lax environmental standards. In the process, the study has identified several trends, consensus, conflicts, approaches, methods, and gaps, all of which help to better understand and improve the environmental conduct of firms, and guide future research.

The implications of this study are many fold. These implications are expanded upon below:

5.1 Theoretical and Research Implications

- A comprehensive literature review based assessment of firm characteristics impact on environment sustainability of firms has not been previously undertaken and constitutes the novelty of this work.

- The study highlights several research gaps in the literature to enhance our understanding of firm characteristics impact on environment sustainability of firms.
- A clear future research agenda including key research questions that require immediate attention is provided.
- The study has identified several meta-factors that can provide practitioners and researchers with a deeper, broader, and simplified conceptualization of the multifaceted impact of firm characteristics on environmental sustainability.
- This study has managed to bring some degree of consensus to the literature as well as dispel some erroneous stereotypes regarding the environmental conduct of firms belonging to a particular firm category. For example, the study findings support the liability of smallness hypothesis. Finally, limited support was found for the 'liability of newness' hypothesis, as not much difference in implementation is witnessed among older and newer firms.

5.2 Practical Implications

- Overall, it was found that environmental practices implementation is greater at large firms' vis-à-vis smaller firms. This means that to promote sector/country-wide environmental sustainability, policymakers and industry groups could encourage diffusion/transfer of environmental knowledge, expertise, and skills from large firms to small firms through programs, collaborative partnerships, and mentoring opportunities and/or by encouraging large firms to pressurize small firms to implement environmental practices.
- Overall, it was found that environmental practices implementation is greater at foreign firms' vis-à-vis local firms. From a foreign policy perspective, this shows that countries looking to improve their environmental sustainability should encourage foreign firms, especially from developed countries, to establish subsidiaries there. Additionally, linking up and building relationships between foreign and local firms can help transfer/diffuse environmental practices.
- Policy makers and practitioners could benefit from this study finding to develop suitable policies/interventions so as to ensure that all firms irrespective of their characteristics can contribute equitably towards environmental sustainability.

5.3 Limitations

Although this study was rigorously done, we acknowledge the limitations, especially those concerning the literature sampling criteria and analysis.

- The final list of studies considered may not be exhaustive because of the limitations in the keywords searched, the database used, and the time period selected.
- Only quantitative-oriented studies (pure competitive or mixed qualitative plus quantitative) were considered. Some useful insight providing studies (that are of a qualitative nature) may, therefore, have been missed. However, this provides an opportunity for future research where a review of the kind done here could be repeated for qualitative studies. Further rich insight from these would be useful in enriching the meta-factors (or the reasoning/explanation) for the differential impact of firm characteristics on environmental sustainability.

However, despite these limitations, the contributions of this study are novel and of significant relevance for both practitioners and researchers.

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Table 1: Number of studies across countries

Country	Number of Studies
China	14
USA	13
Spain	4
UAE	3
UK	3
Ghana	2
India	2
Libya	2
New Zealand	2
Nigeria	2
Turkey	2
Argentina	1
Brazil	1
Canada	1
Chile	1
Czech Republic	1
Germany	1
Hungary	1
Indonesia	1
Malaysia	1
South Korea	1
Taiwan	1
Thailand	1
Wales	1
Multi-country	6

Table 2: Studies on firm characteristics and extent of environmental practices implementation

Study	Firm Characteristic(s) considered	Eco-design	Environmental purchasing	Environmental manufacturing/use of environmental technologies	Environmental packaging	Environmental Transportation	Waste management	End of life environmental practices	EMS and ISO 14001	Environmental training	Environmental auditing	Environmental disclosure/reporting	Environmental- related R&D	Extent of explanation provided
Aragón-Correa (1998)	Size									↑				*
Christmann (2000)	Size			↔										
Theyel (2000)	Size		↔							↔	↑		↔	*
Christmann and Taylor (2001)	Size								↑					**
	Ownership								↑					**
Gil et al. (2001)	Size		↑							↑				**
	Age		↓							↓				**
King and Lenox (2001)	Size			↑			↑		↑					
King and Shaver (2001)	Ownership						↑							**
Min and Galle (2001)	Size		↑		↑			↑						**
King and Lenox (2002)	Size						↔						↔	
Andonova (2003)	Size			↔					↑		↑			
	Ownership			↔					↑		↑			*
Branzei et al. (2004)	Size									↑				
Cormier et al. (2005)	Size											↑		*
	Ownership											↓		
	Age											↑		
Henriques and Sadorsky (2006)	Size									↔	↑	↔		**
	Ownership									↑	↑	↔		**
Sarkis and Dijkshoorn (2007)	Size						↑	↑			↑			*

Study	Firm Characteristic(s) considered	Eco-design	Environmental purchasing	Environmental manufacturing/use of environmental technologies	Environmental packaging	Environmental Transportation	Waste management	End of life environmental practices	EMS and ISO 14001	Environmental training	Environmental auditing	Environmental disclosure/reporting	Environmental- related R&D	Extent of explanation provided
Zhu et al. (2007)	Size	↓	↓						↓		↓			
Aragon-Correa et al. (2008)	Size		↑	↑			↔		↑	↑	↑			*
Brammer and Pavelin (2008)	Size										↑	↑		*
Gonzalez et al. (2008)	Size	↔		↑			↔		↔					**
Henri and Journeault (2008)	Size								↑			↑		**
Luken et al. (2008)	Size			↔										*
	Ownership			↑										*
Lee (2008)	Size		↑						↑					*
	Age		↔						↔					
Russo (2009)	Size								↑					
	Age								↑					
Zhu et al. (2008)	Size	↔	↔	↑	↔	↑		↑	↑		↔			***
Albornoz et al. (2009)	Size								↑					
	Ownership			↑			↑	↑	↑					*
Lewis and Cassells (2010)	Size	↔	↑	↔	↔	↔	↔	↔	↑		↑	↑		*
Eltayeb and Zailani (2009)	Size	↑	↑					↔						
	Ownership	↑	↑					↑						
	Age	↔	↔					↔						
Garcia et al. (2009)	Size								↑					*
	Ownership								↔					

Study	Firm Characteristic(s) considered	Eco-design	Environmental purchasing	Environmental manufacturing/use of environmental technologies	Environmental packaging	Environmental Transportation	Waste management	End of life environmental practices	EMS and ISO 14001	Environmental training	Environmental auditing	Environmental disclosure/reporting	Environmental- related R&D	Extent of explanation provided
	Age								↕					*
Turk (2009)	Size								↑					*
Darnall et al. (2010)	Size									↑	↑	↑	↑	***
	Ownership									↑	↑	↑	↔	*
	Age									↔	↔	↔	↔	*
Qi et al. (2010)	Size			↑			↑	↑				↑	*	
De Villiers et al. (2011)	Size											↑		
	Age											↑		
Qi et al. (2011)	Ownership							↔						*
Abdo and Al-Drugi (2012)	Size											↑		**
	Ownership											↑		**
	Age											↔		**
Zhu et al. (2012)	Size								↑		↑			
	Ownership								↑		↔			**
Ben Brik et al. (2013)	Size	↑	↑	↑	↑		↑							
Serpell et al. (2013)	Size			↑			↑							*
Tambunlertchai et al. (2013)	Size								↑					*
	Ownership								↑					**
Zhu and Geng (2013)	Size	↔	↔	↔	↔	↔		↔						*
	Ownership	↑	↑	↑	↑	↑		↑						*
Tatoglu et al. (2014)	Size		↑	↑			↑							**

Study	Firm Characteristic(s) considered	Eco-design	Environmental purchasing	Environmental manufacturing/use of environmental technologies	Environmental packaging	Environmental Transportation	Waste management	End of life environmental practices	EMS and ISO 14001	Environmental training	Environmental auditing	Environmental disclosure/reporting	Environmental- related R&D	Extent of explanation provided
	Age		↔	↔			↔							**
Singh et al. (2015)	Size								↑					*
	Age								↔					*
Jabbour et al. (2016)	Size	↔	↔	↔	↔	↔	↔							
Haladu and Beri (2016)	Age											↑		*
Li and Chan (2016)	Ownership			↑					↑					**
Ashton et al. (2017)	Size		↑	↑			↔		↑					*
	Age		↔	↔			↔		↔					
Vijayvargy et al. (2017)	Size	↑	↑	↔	↔			↔	↑		↑			***
Welbeck et al. (2017)	Size											↑		**
	Ownership											↔		**
	Age											↑		**
Tang et al. (2018)	Size	↑		↑	↑	↑	↑	↑						
	Age	↔		↔	↔	↔	↔	↔						
Faith et al. (2018)	Ownership		↑	↑			↑				↑			*
Shrivastava and Tamvada (2019)	Size								↑					*
	Age								↑					*

↑ - implies greater; ↓ - lower; or ↔ - similar levels of environmental practices implementation at large firms vis-à-vis small ones; or at foreign firms vis-à-vis local ones; or at older firms vis-à-vis newer ones

Blank implies no explanation; * implies limited explanation; **implies moderate level of explanation; ***implies detailed explanation

Table 3: Studies on firm characteristics and strength/influence of environmental driver(s)

Study	Firm Characteristics considered	Internal drivers		External drivers					Extent of explanation provided
		Environmental commitment	Business benefits	Government environmental regulation	Stakeholder pressure (supply chain)	Societal/NGO pressure	Consumer pressure	Competitor pressure	
Baylis et al. (1998)	Size	↑	↑	↑	↑				***
Christmann and Taylor (2001)	Size			↔					**
	Ownership			↑					**
King and Lenox (2001)	Size			↓					**
King and Shaver (2001)	Ownership			↔					**
Min and Galle (2001)	Size	↑		↔					*
Firestone (2002)	Size			↓					***
King and Lenox (2002)	Size			↑					
Branzei et al. (2004)	Size			↔					
Elsayed (2006)	Size	↑							**
	Age	↓							*
Sarkis and Dijkshoorn (2007)	Size	↑							*
Lee (2008)	Size	↓			↔				*
	Age	↔			↑				*
Zhu et al. (2008)	Size	↔							**
Lewis and Cassells (2010)	Size	↔	↔	↔		↔	↔	↔	*
Darnall et al. (2010)	Size	↓	↔	↓	↓	↔			**
	Ownership	↔	↑	↔	↔	↔			*
	Age	↔	↔	↑	↔	↔			
Kuada and Hinson (2012)	Ownership	↔	↑	↑	↔				**
Ben Brik et al. (2013)	Size		↔	↔			↔	↔	*
Serpell et al. (2013)	Size		↑	↑			↑		*
Aldrugi and Abdo (2014)	Ownership		↑	↑		↔			*
Tatoglu et al. (2014)	Size	↔		↔			↔	↔	*
	Age	↔		↔			↑	↔	*
Faith et al. (2018)	Ownership	↔							*

↑ - implies bigger; ↓ - lesser; or ↔ - equivalent driver for large firms vis-à-vis small ones; or for foreign firms vis-à-vis local ones; or for older firms vis-à-vis newer ones

Blank implies no explanation; * implies limited explanation; **implies moderate level of explanation; ***implies detailed explanation

Table 4: Studies on firm characteristics and strengths/influences of environmental barrier(s)

Study	Firm Characteristics considered	Internal Barriers		External Barriers		Extent of explanation provided
		High costs of implementation	Lack of knowledge and awareness	Lack of green professionals	Lack of green suppliers	
Min and Galle (2001)	Size	↓	↔			**
Lewis and Cassells (2010)	Size	↔	↔	↔		*
Lewis et al. (2015)	Size	↔	↓	↑		*
Jabbour et al. (2016)	Size	↔	↔		↔	*

↑ - implies bigger; ↓ - lesser; or ↔ - equivalent barrier for large firms vis-à-vis small ones

* implies limited explanation; **implies moderate level of explanation

Table 5: Studies on firm characteristics and performance benefits (from environmental practices' implementation)

Study	Firm Characteristics	Performance measures considered	Environmental performance benefits	Cost/Economic performance benefits	Operational performance benefits	Organizational performance benefits	Extent of explanation provided
Pargal and Wheeler (1996)	Size	Water pollution	↑				*
	Ownership		↔				*
	Age		↓				*
Russo and Fouts (1997)	Size	Environmental rating	↔				
Klassen and Whybark (1999)	Size	The total environmental release and transfer of hazardous pollutants	↔				
Christmann (2000)	Size	<i>Environmental performance</i> : Water and waste <i>Cost performance</i> : Cost advantage assessed relative to the firm's major competitors	↔	↔			
Theyel (2000)	Size	Reduction in waste generation	↔				*
King and Lenox (2001)	Size	Waste generation, relative emissions	↑				
King and Shaver (2001)	Ownership	Waste generation	↓				*
Grant et al. (2002)	Size	Toxic emissions	↓				***
King and Lenox (2002)	Size	Toxic emissions	↓				
Eskeland and Harrison (2003)	Ownership	Energy intensity, electricity use	↑				**
Branzei et al. (2004)	Size	Environmental protection record	↑				
Elsayed (2006)	Size	Environmental responsibility score	↑				***
	Age		↓				*
Earnhart and Lizal (2007)	Ownership	Relative emissions	↔				
Wang and Jin (2007)	Ownership	Water pollution	↑				*
Zhu et al. (2007)	Size	<i>Environmental performance</i> : Reduction of air emission; wastewater; solid wastes; hazardous/ harmful/ toxic materials; frequency of environmental accidents	↔	↔	↔		

Study	Firm Characteristics	Performance measures considered	Environmental performance benefits	Cost/Economic performance benefits	Operational performance benefits	Organizational performance benefits	Extent of explanation provided
		<p><i>Cost performance:</i> Decrease of cost for materials purchasing; energy consumption; waste treatment; waste discharge; fines from environmental accidents</p> <p><i>Operational performance:</i> Increase in the amount of goods delivered on time, decrease in inventory levels, decrease in scrap rate, increase in product quality, increased product lines, and improved capacity utilization</p>					
Aragon-Correa et al. (2008)	Size	Return on investment, and earnings growth				↔	*
Lewis and Cassells (2010)	Size	<p><i>Environmental performance:</i> Emissions to air and water</p> <p><i>Cost performance:</i> Reduce fuel costs</p>	↔	↔			*
Russo (2009)	Size	Toxic emissions	↑				
	Age		↓				
Kuada and Hinson (2012)	Ownership	<p><i>Cost performance:</i> Reduction in cost/expenses</p> <p><i>Organizational performance:</i> Increase in earnings</p>		↔		↔	*
Liang (2014)	Ownership	Air Pollution	↑				**
Weng et al. (2015)	Size	<p><i>Environmental performance:</i> Reductions in hazardous waste, and emissions, scrape rate, and increases in regulation knowledge</p> <p><i>Organizational performance:</i> market share, sales, profitability, company's reputation, and competitive advantage.</p>	↑			↔	
	Age		↔			↔	
Jabbour et al. (2016)	Size	<p><i>Environmental performance:</i> Reduction in greenhouse gas emissions; water and electricity power consumption, solid waste, hazardous/toxic material consumption and decrease in the frequency of environmental accidents</p>	↔		↔		*

Study	Firm Characteristics	Performance measures considered	Environmental performance benefits	Cost/Economic performance benefits	Operational performance benefits	Organizational performance benefits	Extent of explanation provided
		<i>Operational performance</i> : Reduction in the time needed to create and deliver new products; successful new product launches; increase in product quality; increase in flexibility to conform to the different requests from clients; and improvement in the capacity to comply with client deadlines					
Li and Chan (2016)	Ownership	Gas emissions, wastewater, and solid waste discharge	↑				*
Vijayvargy et al. (2017)	Size	<i>Environmental performance</i> : Reduction in air emissions, wastewater, solid wastes, hazardous materials consumption, and environmental accidents <i>Cost performance</i> : Decrease in cost of material purchasing, energy consumption, waste treatment, waste discharge, and fines from environmental accidents <i>Operational performance</i> : Increased amount of goods delivered on time, decrease in inventory levels, decrease in scrap rate, increase in product quality, increased product lines, and improved capacity utilization	↑	↑	↑		***
Chang et al. (2018)	Size	Water, material and energy conservation, land use efficiency, emission reduction, noise and light pollution control, and waste management	↑				*
Faith et al. (2018)	Ownership	<i>Environmental performance</i> : Reduction in waste generation <i>Cost performance</i> : Cost incurred <i>Organizational performance</i> : Increase in sales, profit, client base, innovation, and corporate identity	↑	↓		↑	
Tang et al. (2018)	Size	Sales volume, market share, return on investment, firm image, and customer satisfaction				↔	
	Age					↔	

Study	Firm Characteristics	Performance measures considered	Environmental performance benefits	Cost/Economic performance benefits	Operational performance benefits	Organizational performance benefits	Extent of explanation provided
Wang et al. (2018)	Size	Individual measures used for environmental and economic performance is not reported in the study	↑	↑			**
	Age		↔	↔			
Younis et al. (2019); Younis and Sundarakani (2020)	Size	<i>Environmental performance:</i> Reduced air emission, solid wastes, and wastewater, decreased consumption of hazardous materials, and decreased frequency for environmental accidents <i>Cost performance:</i> Decreased cost for materials purchasing and energy consumption, decreased fee for waste treatment and discharge, and reduction in the fine for environmental accidents	↑	↑	↔	↑	**
	Age	<i>Operational performance:</i> Reduction in lead times, improved product quality, design/develop better products, improved its position in the market place, improved chances in successfully selling its products in international markets <i>Organizational performance:</i> Average return on sales and investment, average profit, profit growth, market share growth, and improved corporate image	↔	↔	↔	↔	**

↑ - implies greater; ↓ - lower; or ↔ - similar performance benefit for large firms vis-à-vis small ones; or for foreign firms vis-à-vis local ones; or for older firms vis-à-vis newer ones

Blank implies no explanation; * implies limited explanation; **implies moderate level of explanation; ***implies detailed explanation

Table 6: Meta-factors explaining the heterogeneity in the environmental conduct of different firm types

Newer Firms	Local Firms	Small Firms	Factor	Large Firms	Foreign Firms	Older Firms
Greater & positive influence Pargal and Wheeler (1996); Elsayed (2006); Tatoglu et al. (2014)		Lower & negative influence Baylis et al. (1998); Gil et al. (2001); Min and Galle (2001); Sarkis and Dijkshoorn (2007); Zhu et al. (2008); Lewis and Cassells (2010); Darnall et al. (2010); Zhu and Geng (2013); Vijayvargy et al. (2017); Welbeck et al. (2017); Chang et al. (2018); Ashton et al. (2017) Lower & positive influence Sarkis and Dijkshoorn (2007); Lee (2008); Darnall et al. (2010)	Resources availability (Financial, human, and technological resources)	Greater & positive influence Gil et al. (2001); Elsayed (2006); Henriques and Sadorsky (2006); Gonzalez et al. (2008); Henri and Journeault (2008); Qi et al. (2010); Ben Brik at al. (2013); Tambunlertchai et al. (2013); Tatoglu et al. (2014); Singh et al. (2015); Younis and Sundarakani (2020) Greater & negative influence Firestone (2002); Grant et al. (2002); Darnall et al. (2010)	Greater & positive influence Zhu et al. (2012)	Lower & negative influence Darnall et al. (2010); Singh et al. (2015); Ashton et al. 2017)
		Lower & negative influence Sarkis and Dijkshoorn (2007); Lee (2008)	Technical and managerial know-how	Greater & positive influence Elsayed (2006); Gonzalez et al. (2008)	Greater & positive influence Christmann and Taylor (2001); Albornoz et al. (2009); Zhu et al. (2012) Lower & negative influence King and Shaver (2001)	Greater & positive influence Russo (2009); Welbeck et al. (2017); Younis and Sundarakani (2020)
		Greater & positive influence Aragón-Correa et al. (2008); Darnall et al. (2010)	Innovation Propensity	Greater & positive influence Grant et al. (2002) Lower & negative influence Grant et al. (2002)	Greater & positive influence Qi et al. (2011)	

Newer Firms	Local Firms	Small Firms	Factor	Large Firms	Foreign Firms	Older Firms
		Lower & negative influence Balylis et al. (1998); Lewis and Cassells (2010)	Visibility	Greater & positive influence Gil et al. (2001); Elsayed (2006); Brammer and Pavelin (2008); Gonzalez et al. (2008); Henri and Journeault (2008); Eltayeb and Zailani (2009); Darnall et al. (2010); Tambunlertchai et al. (2013); Tatoglu et al. (2014); Singh et al. (2015); Welbeck et al. (2017); Ashton et al. (2017)	Greater & positive influence Zhu et al. (2012); Tatoglu et al. (2014); Tambunlertchai et al. (2013)	
		Greater & positive influence Darnall et al. (2010)	Reputation and Image	Greater & positive influence Grant et al. (2002); Tambunlertchai et al. (2013); Tatoglu et al. (2014); Chang et al. (2018)	Greater & positive influence Pargal and Wheeler (1996); Christmann and Taylor (2001); Zhu et al. (2012); Tambunlertchai et al. (2013); Tatoglu et al. (2014)	
		Greater & positive influence (Preferential treatment) Aragon-Correa et al. (2008); Ashton et al. (2017); Lee (2008) Greater & negative influence (Preferential treatment) Grant et al. (2002) Greater & positive influence (Discriminatory treatment) Firestone (2002)	Preferential/ Discriminatory treatment	Greater & positive influence (Discriminatory treatment) Grant et al. (2002); Qi et al. (2010) Greater & negative influence (Discriminatory treatment) Firestone (2002); Darnall et al. (2010)	Greater & negative influence (Preferential treatment) King and Shaver (2001); Andonova (2003); Eskeland and Harrison (2003); Liang (2014); Tatoglu et al. (2014) Greater & positive influence (Discriminatory treatment) King and Shaver (2001); Pargal and Wheeler (1996); Zhu et al. (2012)	

Newer Firms	Local Firms	Small Firms	Factor	Large Firms	Foreign Firms	Older Firms
<i>Lower & positive influence</i> Elsayed (2006)		<i>Lower & positive influence</i> Aragón-Correa et al. (2008); Lewis and Cassells (2010); Darnall et al. (2010) <i>Lower & negative influence</i> Wang et al.(2018)	Bureaucracy and Organizational Inertia	<i>Greater & negative influence</i> King and Shaver (2001); Darnall et al. (2010) <i>Greater & positive influence</i> Gil et al. (2001); Elsayed (2006); Henri and Journeault (2008)	<i>Greater & positive influence</i> Tambunlertchai et al. (2013); Welbeck et al. (2017)	<i>Greater & negative influence</i> Gil et al. (2001)
		<i>Lower & negative influence</i> Zhu et al. (2008)	Economies of Scale	<i>Greater & positive influence</i> Gil et al. (2001); Min and Galle (2001); Elsayed (2006); Younis and Sundarakani (2020)		
	<i>Greater & positive influence</i> Kuada and Hinson (2012)	<i>Greater & positive influence</i> Baylis et al. (1998); Aragón-Correa et al. (2008)	Corporate Environmental commitment	<i>Greater & positive influence</i> Brammer and Pavelin (2008); Eltayeb and Zailani (2009)	<i>Greater & positive influence</i> Zhu et al. (2012) <i>Lower & negative influence</i> Henriques and Sadorsky (2006); Tambunlertchai et al. (2013)	
<i>Greater & positive influence</i> Tatoglu et al. (2014)		<i>Greater & positive influence</i> Gonzalez et al. (2008)	Legitimacy Seeking Behavior	<i>Greater & positive influence</i> Cormier et al. (2005); Elsayed (2006)	<i>Greater & positive influence</i> Darnall et al. (2010); Zhu et al. (2012); Kuada and Hinson (2012)	<i>Greater & positive influence</i> Welbeck et al. (2017)