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ARTICLE

Stakeholder perceptions of the benefits and barriers of implementing environmental management systems in the Maldivian construction industry

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Abstract

Unprecedented increases in both tourism and population growth have put extreme pressure on the Republic of the Maldives, which has resulted in significant changes to the islands as a result of construction activities. This study is the first to investigate perceptions of the benefits and barriers of implementing environmental management systems (EMS) in the Maldivian construction industry, and what effective measures and strategies exist to drive environmental management practices. A subjectivist stance and deductive approach have been taken with an online survey adopting a quantitative strategy with a range of construction professions across the Maldivian construction sector. Using a central tendency measure of weighted average, the respondents' opinions suggest that the primary benefits of having an EMS in the Maldives are perceived as the enhancement of corporate image and environmental protection; while the major barriers are lack of legal enforcement and the requirement for company structures and policies to change to accommodate an EMS. The findings also suggest that those companies who establish a waste management plan and where authorities enforce legal environmental requirements are believed to be the most effective means to encourage more widespread adoption. Based on these findings, it is recommended that managers, need to increasingly promote the principles of environmental management and sustainable practices/behaviours amongst construction industry stakeholders. Furthermore, policy makers within the Maldives should be exploring the viability of establishing financial incentive schemes (particularly for SMEs), in addition to encouraging wider adoption of EMSs across the Maldivian industry sectors.

Keywords ISO14001 · Environmental management · Environmental standards · Corporate social responsibility · Sustainable construction · Maldives

List of symbols

BIV_i Benefit/barrier index value for each statement i

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j	Numerical value for each ranking level, in which 1 is allocated to the lowest rank and 5 is allocated to the highest rank
N	Total number of respondents for the question
nij	Number of respondents for statement i with ranking level j
WAS_i	Weighted average score for each statement i
δ_i	Standard deviation for each statement i

Abbreviations

AAM	Architects Association of Maldives
AME	Association of Maldivian Engineers
BOS	Bristol online survey
EIA	Environmental impact assessment
EMS	Environmental management system
GDP	Gross domestic product
GHG	Greenhouse gases
ISO	International Standards Organisation
SDG	Sustainable development goals
SME	Small and medium sized enterprise
MACI	Maldives Association of Construction Industry
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UWE	University of the West of England

1 Introduction

The construction industry is widely recognised as a major cause of environmental issues accounting for a larger percentage of GHG emissions, land contamination, biodiversity loss and water usage (Hammond & Booth, 2010). Some construction organisations are becoming more environmentally proactive, which may be as a result of it being perceived to yield positive social, economic and environmental outcomes (Lisi, 2015). A method that can be used to facilitate this is the implementation of an environmental management system (EMS), such as the ISO 14001, which provides a mechanism by which companies can integrate sustainable practices and environmental principles into their business operations (Zhang et al., 2000).

Environmental management was traditionally seen as being a top–down approach, restrictive and reactive in nature, defined by the implementation of environmental policies enforced through laws and fines (Barrow, 2005; Tinsley, 2014). However, as the system has developed it has become more open in approach; enabling more consultation and engagement with stakeholders which is seen as critical to achieving the aim of improving environmental management (Coccia & Watts, 2020; Reed, 2008). Some researchers have noted that by placing environmental management at the core of an organisation's mission it enables it to work towards environmental integrity and social equity (Barrow, 2005; Keene and Pulllin, 2011; Vasovic et al., 2017).

Environmental management practices can be defined as "*the techniques, policies and procedures a firm uses that are specifically aimed at monitoring and controlling the impact of its operations on the natural environment*" (Yu & Ramanathan, 2016). The positive

impacts of environmental management on business performance have been recognised since its inception in the 1970s. Many researchers have reiterated the view that environmental management positively influences the economic performance of an organisation (Gotschol et al., 2014; Yu & Ramanathan, 2016). These practices are shown to minimize risks, improve revenue and strengthen stakeholder relations (Ervin et al., 2013). However, Yang et al. (2009) suggests that environmental management does not directly influence financial performance, rather it is the resulting improved environmental performance that reduces negative environmental impacts on the economic performance of an organisation. Barrow (2005) suggests environmental management can contribute to sustainable development as it can identify key issues, threats, opportunities, and limits, as well as determine realistic strategies by coordinating the physical, biological and socio-economic interests of the stakeholders. These stakeholders can include members of the public, noting that public pressure has intensified, and the increased awareness of the natural environment has contributed to an improved corporate accountability and responsibility (Ormazabal et al., 2017). Along with the public desire for better protection of the environment there has been an increase in regulatory standards, as well as market pressures to protect investors' interests and maintain competitiveness, which have also contributed to promote positive actions (Ervin et al., 2013; Khanna & Speir, 2013; Ormazabal et al., 2015). Within organisations, Ormazabal et al., (2015) noted that efforts are often managerially driven by attitude, organisational frameworks and training mechanisms.

Implementation of environmental management measures across organisations have resulted in the development of many tools and techniques to monitor, forecast and aid management decision-making, as Barrow (2005) argues '*what cannot be measured, cannot be managed*'. Environmental impact analyses, environmental flow assessments, life cycle assessments and standardized environmental management systems have all become a means to manage the environmental commitments of organisations (Ormazabal et al., 2015). More recently, powerful technological mechanisms, such as remote sensing and geographical information systems, have demonstrated their capacity to support environmental management processes (Herbei et al., 2016). However, all these tools require funding and financial constraints remain the major barrier towards the adoption of environmental management practices within organisations (Ervin et al., 2013; Kuppig et al., 2016), particularly in developing nations.

The Maldives, often defined as a 'paradise on earth', has become a magnet for global tourists in recent decades (Bowen et al., 2017; de-Miguel-Molina et al., 2014; Niyaz, 2002). However, this is a developing nation and parts of the island group are now amongst the most densely populated places on the planet (i.e. Island of Male') (UN, 2020). A developing nation with unprecedented growth and the resulting environmental pressures creates a perfect storm due to the demands of construction associated activities (Bowen et al., 2017; Cowburn et al., 2018; Karthikheyan, 2010; UNEP, 2006; Zubair et al., 2011). These issues support Barrow's (2005) point that it is important to examine local conditions and engage with stakeholders at community level to seek suitable environmental remedies for the developing world. Developed countries and multi-national corporations have largely driven environmental management efforts, while the developing nations focus has been on the struggle to tackle socio-economic issues, such as extreme poverty and poor infrastructure. Therefore, the purpose of this study is to explore the potential of EMS for managing these challenges by examining the perceptions of the benefits and barriers of implementing EMSs within the construction sector of a developing nation, the Maldives. In doing so, the study highlights the primary benefits that are perceived to be the key drivers for stimulating environmental management in construction organisations across the Maldives. Further, it

also emphasises the barriers that must be addressed both by the government, as well as by the industry stakeholders, to improve the environmental impacts due to construction activities. This is important because the information is crucial for the formulation of strategies that could be implemented to enhance the adoption of EMSs in construction practices.

The article is organized as follows: the next section proffers a background to EMS and ISO 14001, before reviewing literature that covers its adoption across construction sectors; a description of the case study country and details of the methods used to collect and analyse data are then revealed; thereafter, presentation of the findings and an associated discussion follow, before conclusions are drawn and related recommendations made.

2 Background

2.1 Environmental management systems

Environmental management systems are a holistic approach by which organisations can identify and manage the environmental impacts of their business activities, products, and services (Sunderland, 1997). An EMS is identified as a self-disciplined strategic management tool, used by organisations to drive their environmental commitments (Zhang and Tang (2019). The approach used in an EMS follows Deming's management cycle of 'Plan–Do–Check–Act', which provides a cyclical mechanism to ensure continual improvements in environmental performance (Barrow, 2005; Tinsley, 2014). Its use is intended to address the environmental impacts by considering firstly the organisational structure and operational framework (Tambovceva, 2016). It then needs to encompass the environmental policy commitment as a minimum and present a detailed structure and documentation template, usually verifiable by a third-party external auditor (Tinsley, 2014). The system itself comprises several interlinked elements to encourage an organisation to set objectives against which its performance is measured, and corrective actions that are taken (Barrow, 2005; Delmas, 2000).

An increasing number of organisations have implemented EMSs primarily driven by the opportunity it presents to showcase their environmental commitment (Castka & Prajogo, 2013). Some perceived benefits are improved corporate image and enhanced public perception (Arulrajah et al., 2015; Horry et al., 2022; Santos et al., 2016). It also provides a platform to communicate the environmental performance of an organisation to the wider audience through certification (Camilleri, 2022; Hibiki & Arimura, 2011). It has been suggested that EMS also promote financial benefits (Berrone and Gomez-Mejia, 2009; Mariotti et al., 2014; Zhang et al., 2022). They are also credited with promoting sustainable practices by increasing the environmental awareness within the employees (Boiral et al., 2018; Johnstone, 2022; Zhang et al., 2014) and standardizing management procedures to minimise negative environmental impacts (Barrow, 2005; Gallagher et al., 2004; Ong et al., 2023). Other internal benefits which are acknowledged within the use of an EMS include improved energy efficiency (Jeong & Lee, 2023; Pesce et al., 2018) and waste minimization (Camilleri, 2022; Comoglio & Botta, 2012). External motivation includes pressures from the supply chain and legal compliance (Hillary, 2004; Jum'a et al., 2022; Tinsley, 2014; Zhang et al., 2014).

An EMS, while useful in encouraging best practices and setting benchmarks, does not provide a complete solution for environmental management. Sunderland (1997) argues that meeting the specifications of an EMS does not guarantee a strong commitment towards

environmental management. Additionally, he suggests environmental management standards do not assure continued improvements in environmental performance unless woven in to the Organisation's business as usual activities, and at worst could potentially encourage separation of EMS effort from existing business practices. EMS is also criticised as a management approach, as it does not guarantee optimal results in environmental outcomes even though it promotes continual improvement of environmental performance (Gallagher et al., 2004; Qi et al., 2013).

While the use of EMS has proliferated in recent years, many organisations have not used the standard due to financial barriers, such as return on investment, payback and limited investment capital (Kuppig et al., 2016). Hillary (2004) pointed that SMEs are further challenged by barriers such as lack of knowledge towards the environment and lack of pressure within the supply chain supported in Horry et al. (2022). A lack of human resources is also cited as a barrier to implementing an EMS (Bracke et al., 2008; Waxin et al., 2023). All issues which will influence the use of ISO 14001 within the Maldivian construction sector,

2.2 ISO 14001

ISO 14001 is the most widely recognised global EMS standard. Originally published in 1996 (Boiral & Sala, 1998; Hillary, 2000) and updated in 2004 and again in 2015. ISO14001 has experienced rapid growth with over 300,000 certifications issued in 171 countries worldwide (International Organisation for Standardization, 2015). It is intended to provide harmonisation, to avoid trade barriers and potential conflicts in businesses (Chan & Wong, 2006; Muktiono & Soediantono, 2022; Sunderland, 1997). As a system it has demonstrated significant influence in the field of environmental management, as ISO 9000 did in quality assurance and management areas (Psomas et al., 2011), providing a means to manage organisations environmental performance (Carrillo-Labella et al., 2020).

ISO 14001 is based on a top–down management approach encompassing the traditional management principles of commitment and policy, planning, implementation, and operation, checking and corrective action, management review and continual improvement (Boiral & Sala, 1998). It is suggested that top management commitment, which became explicitly required in the 2015 version (Chiarini et al., 2018; Chiarini, 2019) of the standard is the single most important factor to ensure the successful implementation, as it helps motivate the employees towards continuous improvement, while showcasing the ethical position of the organisation on environmental issues to the wider audience (Bridgen & Helm, 2000; Ejdys et al., 2016). A factor which links to the work of Balzarova et al. (2006) who highlighted the four dimensions of organisational culture: people, process, structure, and environment as influencing factors in the implementation of the ISO 14001 standard.

Other studies have suggested organisations are primarily driven to implement ISO 14001 due to the competitive advantage gained through the improved corporate image (Bailey et al., 2020; Feng et al., 2016; Schmidt et al., 2017), as well as sustainable outcomes (Castka & Balzarova, 2008; Liu et al., 2012). This improved corporate image is supported by researchers who state that ISO 14001 improves relations with stakeholders, due to the responsible environmental measures adopted in business practices (Castka & Balzarova, 2008; Horry et al., 2021; Poksinska et al., 2003; Psomas et al., 2011). All issues which are thought to exist within the construction sector within the Maldives.

ISO 14001 when used well is a proactive approach to help minimise environmental impacts, but it is criticised as a management standard because it does not guarantee any real improvements in environmental performance, as the standard does not explicitly state

the criteria for defining and measuring a particular environmental aspect (Mariotti et al., 2014; Valdez & Chini, 2002). This is reflective of a concept termed 'symbolic adoption', which refers to the "*use of standards by firms as a way to legitimise environmental practice by looking for the support from the institutional environmental but without necessarily implying real environmental commitment*". This concept is detrimental to the credibility and reliability of the standard, as it does not result in a tangible reduction of any negative environmental impacts (Ferron-Vilchez, 2016). Furthermore, the effectiveness of ISO 14001 as a proactive management model is challenged by Ball (2002), as it is suggested the standard is only useful in reducing the impact, in reaction to environmental issues. Thus, the ISO 14001 standard is perceived as a tool, rather a means of addressing the environmental management concerns in an organisation (Boiral & Sala, 1998).

Despite all these concerns ISO 14001 is becoming increasingly popular in the developing world, as it provides the opportunity for organisations to demonstrate legal compliance in respect of environmental legislation. However, limited financial capital and human resources, as well as lack of awareness and knowledge within the organisations, has impeded the widespread implementation of ISO 14001 standard in some developing nations (Davy, 1997; Owolana & Booth, 2016). Hortensius and Barthel (1997) also emphasise poorly defined legislation and enforcement structure as barriers to organisations effectively managing and measuring their environmental performance through a formally recognised EMS. Therefore, Davy (1997) proposes it necessary for developing nations to receive external support and assistance, to encourage the uptake of environmental management in commercial activities.

2.3 Environmental management in construction

The construction industry is perceived as a key player in the national economies of both the developed and developing nations, owing to its investment value, job creation potential and contribution to the GDP (Zhang et al., 2000). The industry is closely linked to the indices of sustainable development in the form of the Sustainable Development Goals (SDGs), as construction activities significantly impact the natural environment, as well as the social and economic conditions of a society (Du Plessis, 2007; Myers, 2005). Christini et al. (2004) suggests the construction industry would benefit greatly from having a comprehensive and certified EMS, while Murillo-Avalos et al. (2021) note it would help deliver on the SDGs. In response to the increasing pressure on the construction industry to be more ecologically responsible, organisations have developed various methodologies such formal EMSs to support the protection of the natural environment (Camilleri, 2022; Kartam et al., 2004; Liyin et al., 2006). This may assist a sector which is often criticised due to its poor performance and wasteful practices, resulting from the fragmented and diverse nature of the industry (Liu et al., 2012).

The role of the government and local institutions are also highlighted, as it is suggested that legal enforcement and financial incentives could promote the implementation of EMS in the construction industry (Bashir et al., 2022; Ofori et al., 2002; Sakr et al., 2010; Tam, 2008). Liyin et al. (2006); Serpell et al. (2013) support this idea that the construction industry environmental management practices are primarily driven by legislative and regulatory pressures. It is to a lesser degree influenced by client demands and the competitive advantage (Selih, 2007; Serpell et al., 2013; Rodriguez et al., 2011), which has a financial impact (Chen et al., 2016; Vatalis et al., 2011). Studies across several countries have revealed that organisations are primarily driven by economic benefits, plus other

factors such as improved corporate image and opportunity to access international markets (Hasanah et al., 2022; Owolana & Booth, 2016; Tam, 2008; Tambovceva & Geipele, 2011; Zhang et al., 2000). This has resulted in construction organisations becoming more receptive to the notion of environmental management within their organisations (Yusof et al., 2016).

It is recognised that environmental management measures in construction are directly related to the reduction of environmental risks and improving environmental protection efforts (Shen & Tam, 2002). A formal EMS is perceived to improve the efficiency in waste management (Arimura et al., 2008; Camilleri, 2022; Turk, 2009) and contribute significantly to protection of the natural environment (Owolana & Booth, 2016; Zhang et al., 2000). However, even though interest in environmental issues continues to grow, implementation of EMS in organisations is still relatively uncommon (Schmidt & Osebold, 2017; Turk, 2009). Furthermore, to avoid the mistakes of the developed nations, developing nations should aim for meaningful dialogue between stakeholders at all levels of government, broader construction industry and civil society, as it is evident that lack of integrated decision-making leads to poor connections between policies and reality (Du Plessis, 2007).

Barriers to the engagement of environmental management practices in the construction industry have been noted as being lack of knowledge and awareness, limited human resources, expertise and financial constraints (Brennan & Cotgrave, 2014; Sakr et al., 2010; Shen & Tam, 2002), especially in developing nations (Owolana & Booth, 2016; Turk, 2009). Liyin et al. (2006) further suggests the passive environmental culture in the construction industry impedes organisations from adopting a proactive approach towards protecting the natural environment.

2.4 Uptake of environmental management systems in Maldivian construction

The first Maldivian National Building Code (introduced in 2008), governing building practices in the country (Ministry of Construction & Public Infrastructure, 2008) counteracts observations by Shaheen and Charoenngnam (2004) who noted mechanisms in Maldivian construction activities lack adequate consideration for the natural environment. They also suggest stakeholders within the industry are uninformed on sustainable construction practices and highlighted the need for greater emphasis on construction and its impact on the environment. The Construction Industry Development Board was established in 2014 with the main intent of contributing to the development of the industry and to provide support to the Ministry in formulating policies, regulations, standards and procedures (Ministry of Housing & Infrastructure, 2014). The Implementation of Construction Law in the Maldives (April 2017) mandated the enactment of the National Building Code. However, the Law does exempt construction activities on lagoons and islands leased for tourism (Moosa, 2017). However, in the regulatory guidelines for tourist resort developments mandated under the Ministry of Tourism it does state that tourist resort projects must gain environmental permits such as approvals from statutory bodies for environmental impact assessment (EIA) studies, land reclamations, dredging of lagoons and for the felling of coconut palms and trees (Ministry of Tourism, 2005). So, a situation exists where companies need to assess their environmental impacts and EMS could assist in this process.

Environmental management practices are uncommon in the Maldivian construction industry in comparison to the UK. EMS in the Maldives is in its infancy, and there are no known studies that have explored the uptake of EMS in the Maldivian construction sector.

This paper sets out to address this issue using the wealth of existing studies that have explored the uptake worldwide which identified diverse sets of benefits and barriers of implementing EMS (Bailey et al., 2020; Owolana & Booth, 2016; Shen & Tam, 2002). The known benefits, barriers and implementation strategies for EMS, which have been detailed and discussed in the articles already mentioned and other, more general, EMS literature, are surmised in Tables 1, 2 and 3.

3 Methodology

The flowchart presented in Fig. 1 illustrates the methodological sequence of steps adopted in this study.

3.1 Case study

The Republic of Maldives is an independent archipelagic, a small island developing state of 341,256 residents (Asian Development Bank, 2015), located in the Indian Ocean, comprising 26 atolls that stretch 750km north–south. The ocean area is extensive, with an exclusive economic zone of 859,000 km^2, but land (coral reefs and sand bars) is scarce, with total area 298 km^2 (Buckley et al., 2017). Of the 1192 low-lying individual islands in the Maldives, 188 are recognised as being 'inhabited' while 1004 are classed as 'uninhabited.' Of the inhabited islands, only 2.5% support populations greater than 5000 residents; whilst ~ 60% support 1000–5000 residents. The remaining islands have less than 1000 residents (Buckley et al., 2017). Karthikheyan (2010) highlights the lack of land to accommodate the growing population and the limited resources to build the necessary infrastructure poses a significant challenge. This is seen in the capital-city island of Male which is home to ~ 35% of the Maldivian population. Here, population growth and urbanisation has been rapid in recent decades. Policy bias towards the capital city, alongside progressive migration, has further exacerbated the issue. To ease the land demand pressures the island's land mass was extended 15 ha with coralline landfill (blasted from coral reefs). Despite this work the amount of new land has proved insufficient (Naylor, 2015). On an island where natural resources are scarce, coral constructed buildings were favoured as replacements to traditional wooden-frame houses until the realisation of the environmental impact of the destroying reefs was fully appreciated. To disrupt the supply chain of coral blocks (now made illegal) being used on construction projects, the government made the decision to subsidize concrete block manufacture (made possible by economic growth) by importing aggregates. However, the need to provide housing remains and, as is a common consequence of a housing market that cannot meet demand, it has been reported that housing conditions and the associated services are acutely inadequate in Male', and several other islands (Mohit & Azim, 2012; World Bank, 2003). To further ease land demand pressure, the artificial landfill island of Hulhumale' (182 ha; started in 2003) has been built on the nearby reef flats of Hulhule' Falhu with the expectation of housing 150,000 inhabitants by 2020 (Naylor, 2015).

The Maldivian economy has been highly dependent for the last 50 years on tourism and leisure industries. For instance, in 2015, tourism accounted for 24% of the GDP, 32% of direct employment, and 41% of government revenue (National Bureau of Statistics, 2016; Shakeela & Weaver, 2018). Tourism in the Maldives initially developed in an unplanned laissez-faire manner (1972–1983) through the private sector (Bowen et al., 2017). The

Table 1 List of known beneficial factors identified in EMS literature

	Benefit Factors	References
A	Cost savings due to the reduction of fines associated with convictions	Owolana and Booth (2016), Rino and Salvador (2017) and Pesce et al. (2018)
B	Improving corporate image in environmental performances	Abdullary and Fuong (2010), Arulrajah et al. (2015) and Bernardo et al. (2015)
C	Contribution to the improvement of public environmental standards	Ololade and Rametse (2018), Bailey et al (2020) and Johnstone (2020)
D	Contribution to environmental protection	Owolana and Booth (2016), Santos et al. (2016) and Pesce et al. (2018)
E	Increasing overall business competitiveness	Darnall et al. (2008), Aiyub et al. (2009) and Castka and Prajogo (2013)
F	Reduction of environmental complaints	Turk (2009), Owolana and Booth (2016) and Bailey et al. (2020)
G	Improving staff work environment, thus increasing their morale	Darnall and Edwards (2006), Gavronski et al. (2008) and Arulrajah et al. (2015)
H	Reduction of environment-related sickness and injuries	Turk (2009), Nguyen and Hens (2015) and Santos et al. (2016)
I	Reduction of environmental risks—polluted air, lands and water	Darnall and Edwards (2006), de Oliveira et al. (2010); Hibiki and Arimura (2011)

Table 2 List of known barrier factors identified in EMS literature

	Barrier Factors	References
A	Lack of government legal enforcement	Christini et al. (2004), Massoud et al (2010) and Mariotti et al. (2014)
B	Increase in management and operation cost	Bellesi et al. (2005), Campos et al. (2016) and Boiral et al. (2018)
C	Lack of trained staff and expertise	Kim et al. (2015) and Campos et al. (2016)
D	Lack of client support	Owolana and Booth (2016), Bailey et al. (2020) and Johnstone (2020)
E	Lack of sub-contractor cooperation	Owolana and Booth (2016) and Bailey et al. (2020)
F	Lack of supplier cooperation	Mariotti et al. (2014) and Owolana and Booth (2016)
G	Difficult coordination of environmental performance among multi-tier subcontractors	Mariotti et al. (2014) and Bailey et al. (2020)
H	Lack of working staff support	Chavan (2005), Kim et al. (2015) and Ololade & Rametse, 2018
I	Time consuming for improving environmental performance	Teriö and Kahkonen (2011), Owolana and Booth (2016) and Bailey et al. (2020)
J	Change of existing practice of company structure and policy	Yusoff et al. (2015), Owolana and Booth (2016) and Bailey et al. (2020)
K	Increase in documentation workload	Owolana and Booth (2016), Schmidt and Osbold (2017) and Bailey et al. (2020)
L	Lack of tailor-made training on environmental management	Yusoff et al. (2015), Owolana and Booth (2016) and Bailey et al. (2020)
M	Lack of technological support within organisation	Selih (2007) and Owolana and Booth (2016)

Table 3 List of known implementation strategy factors identified in EMS literature

	Strategy Factors	References
A	Legal requirements on environmental protection	Schmidt et al. (2017), Ololade and Rametse (2018) and Johnstone (2020)
B	Reduction, reuse and recycling of construction and demolition wastes	Teriö and Kahkonen (2011), Bailey et al. (2020) and Johnstone (2020)
C	Imposing responsibilities of protecting environment on managerial staff	Sambasivan and Fei (2008) and Chiarini (2019)
D	Applying environmentally friendly technology on site	Sambasivan and Fei (2008) and Padma et al. (2008)
E	Providing in-house training on environmental management	Rodriguez et al. (2007), Nguyen and Hens (2015) and Yusoff et al. (2015)
F	Establishing waste management processes	Turk (2009), Tse (2001), Swaffield and Johnson (2005), Bailey et al. (2020) and Johnstone (2020)
G	Continuous efforts in improving environmental management	Ololade and Rametse (2018), Bailey et al. (2020) and Johnstone (2020)
H	Inclusion of environmental management in tendering requirements	Turk (2009), Rodriguez et al. (2011) and Bailey et al. (2020)
I	Effective communication of environmental issues between all layers of subcontractors	Christini et al. (2004), Turk, 2009 and Nguyen and Hens (2015)
J	Close supervision at site level	Ofori et al. (2000), Shen and Tam (2002) and Dejkovski (2016)

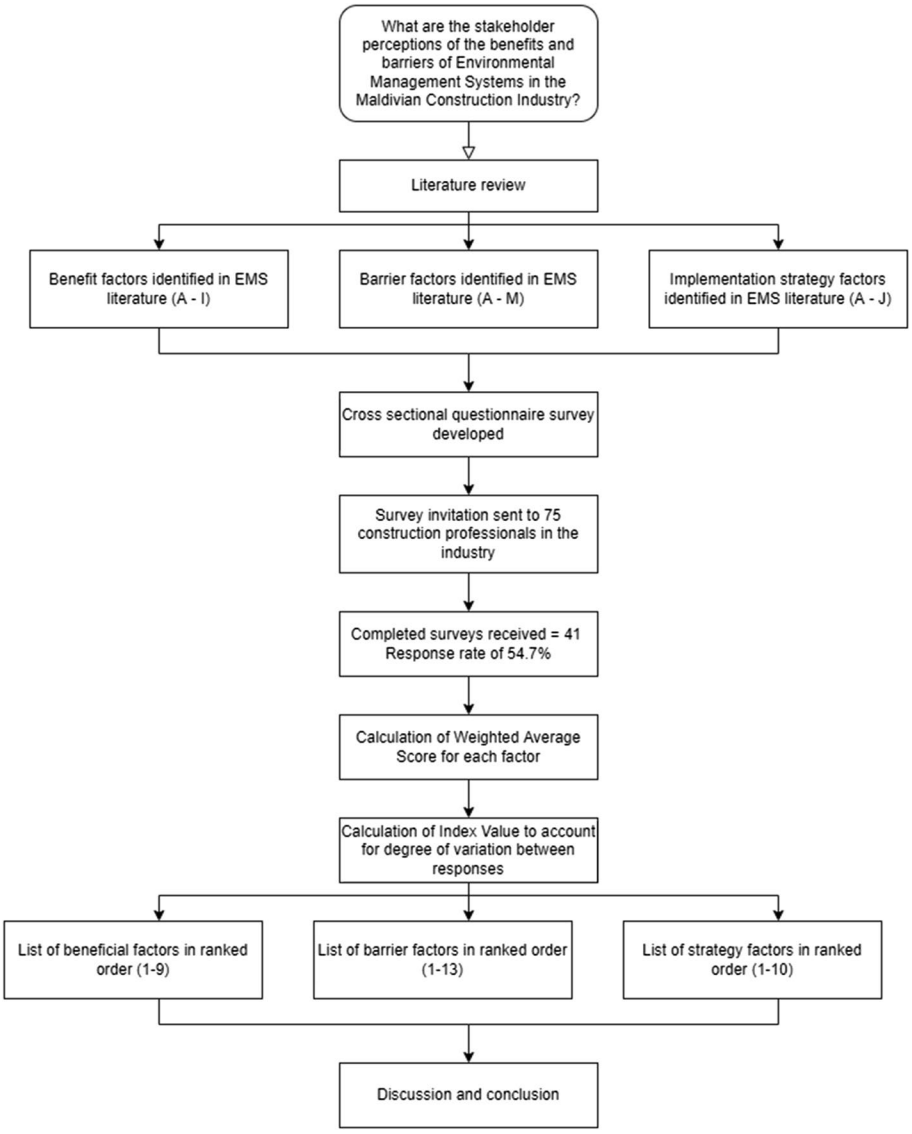

Fig. 1 Illustrative flowchart to describe the methodological steps of the study

Government who owns the land in the Maldives it opted to lease its islands for tourism resort development through a strict policy of enclave resorts (known as one island-one resort tourism (Bowen et al., 2017)) on previously uninhabited islands (Buckley et al., 2017). In 1983 there were 14 resort islands; in 2007 there were 89; and in 2015 there were 111 resorts in operation, with a joint capacity of 23,917 beds (Ministry of Tourism, 2015). These island resorts are autonomous units, totally self-contained, providing their own infrastructure; electric power, water supply, accommodation, restaurants, leisure facilities, sewage and solid waste disposal, plus housing and other facilities for employees (Bowen

et al., 2017; Zubair et al., 2011). However, a change in the nation's tourism master plan policy (in 2008) now permits *"guesthouse tourism"* on inhabited islands. This has enabled the construction of 9 hotels (1704 beds) and 220 guesthouses (3,209 beds), together with the use of 161 safari vessels (2739 beds). In 2015, a further 82 resorts and 7 hotels were under development, with additional capacity of 13,067 beds (Buckley et al., 2017; Ministry of Tourism, 2015). It is estimated this will enable 1.5 million tourists to stay each year (Ministry of Tourism, Arts & Culture, 2012; Bowen et al., 2017).

These conflicting needs of houses and tourism have resulted in development of both new and improved infrastructures, buildings (hotels and houses), and services across many of the Maldives' islands to continuing at a pace. Therefore, in a place where the tourism product is sold as a luxury brand, it is essential that construction organisations proceed in a sustainable manner with the acknowledgement of 'the environment' as a stakeholder across the industry, to preserve the natural environment for residence and tourist alike (Hammond & Booth, 2010).

3.2 Data collection

A subjectivism epistemology (i.e. reality is made from perception and actions), applying a deductive reasoning approach was applied to this study. Therefore, aligned to the study's aim, a quantitative cross-sectional questionnaire survey was adopted as the method of inquiry, enabling the capacity to collect a large amount of statistical data in a controlled setting with minimal influence by the researcher. The choice of this strategy was borne out of the need to capture both the benefits and the barriers of implementing EMSs in Maldivian construction organisations and accords with the approach used in similar studies by Shen and Tam (2002), Owolana and Booth (2016) and Bailey et al. (2020).

An exhaustive online search for construction organisations with company websites was utilised to identify organisations and individuals to invite to participate in the survey, as despite the creation of the Maldives Association of Construction Industry (MACI) founded 2001, the Association of Maldivian Engineers (AME) founded in 2008 and the Architects Association of Maldives (AAM) founded in 2017, currently there is no single public register listing construction companies within the country. Notwithstanding the limited size of the country and the construction sector across the Maldives, this search enabled 75 email invitations to be sent to a range of people holding a variety of construction roles across the sector (this included architects, surveyors, engineers, project managers and directors, amongst others). It is readily acknowledged this sample selection approach creates a bias towards those construction companies with an online presence. However, most companies who choose to engage with an EMS appear to have company websites. The email invitation to participants introduced the purpose of the study and a hyperlink to the questionnaire, available through the Bristol Online Survey (BOS) tool (now known as www.onlinesurveys.ac.uk).

The questionnaire survey consisted of four main sections: participant background information, benefits of an EMS, barriers of an EMS, and implementing an EMS. Section 1 was designed to capture the respondent's professional details and their construction industry experience; Section 2 listed nine factors used to determine apparent organisational advantages of having an EMS (derived from Table 1); Section 3 listed thirteen factors used to gauge perceived organisational challenges against having an EMS (derived from Table 2); and Section 4 listed ten factors used to capture possible organisational implementation strategies for having an EMS (derived from Table 3). For Sects. 2–4, participants were

asked to record their opinions for each factor on a five-point Likert-type scale (1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, and 5 = *strongly agree*) in a horizontal grid system stored as ordinal data.

Ethics and moral standards are integral to research studies. Therefore, all participants were informed their involvement was voluntary and their decision to return their questionnaire would be deemed as their consent to take part in the survey. As their responses would be anonymous, participants were also informed that there would be no opportunity to withdraw once the completed survey had been returned. The study was conducted in accordance with the ethics regulations at the University of the West of England (UWE), Bristol.

3.3 Data analysis

The primary data was entered into Excel (2016 version) and analysed by using a descriptive statistical tool: the central tendency measure of weighted average, as previously employed in research studies (Shen & Tam, 2002; Owolana & Booth, 2016 and Bailey et al., 2020). Additionally, the demographical information was analysed by means of frequency analysis to provide a snapshot of the respondents' characteristics.

The following weighted average formula was used to calculate the average score for each factor. Where: WAS_i denotes the weighted average score for each factor i, α_j denotes the numerical value for each ranking level in which 1 is allocated to the lowest rank and 5 is allocated to the highest rank, n_{ij} denotes the number of respondents for factor i with ranking level αj and N denotes the total number of respondents for the question.

$$WAS_i = \frac{\sum_{j=1}^{5}(\alpha_j n_{ij})}{N} \tag{1}$$

Equation (1) Formula for Weighted Average Score

Shen and Tam (2002) further suggested that an additional formulation was required to address the weakness of the Weight Average Score, which did not account for the degree of variation between the responses. Hence, a coefficient of variation was added to each of the Weighted Average Scores to compute the Benefit/Barrier Index Value (BIV), which determined the final rankings as shown in the formula below.

$$BIV_i = WAS_i + \frac{WAS_i}{\delta_i} \tag{2}$$

Equation (2) Formula for the Index Valuewhere BIV_i denotes the Index Value for each factor i and δ_i denotes the standard deviation for each factor i.

This method of analysing the questionnaire data is the same used in other built environment studies (e.g. Ball & Booth, 2021; Begum et al., 2009) and other environmental management system studies (e.g. Bailey et al., 2020; Olowana and Booth, 2016).

4 Results and discussion

Following screening of the returned questionnaires and scrutiny for missing data, the final response rate yielded 41 complete surveys (54.7%). Although this may be considered a small number of respondents, the response rate (based a limited sample size) is better than those reported for similar online surveys from other developing countries. Findings from

Table 4 List of beneficial factors

Code	Benefit Factors
BF–a	Cost savings due to the reduction of fines associated with convictions
BF–b	Improving corporate image in environmental performances
BF–c	Contribution to the improvement of public environmental standards
BF–d	Contribution to environmental protection
BF–e	Increasing overall business competitiveness
BF–f	Reduction of environmental complaints
BF–g	Improving staff work environment, thus increasing their morale
BF–h	Reduction of environment-related sickness and injuries
BF–i	Reduction of environmental risks-polluted air, lands and water

Table 5 Survey responses and calculation of parameter values to beneficial factors

Code	SA	A	N	D	SD	Total	WAS	δ	BF–BIV	Rank
BF–a	3	22	12	4	0	41	3.59	0.76	8.28	8
BF–b	13	27	1	0	0	41	4.29	0.51	12.78	1
BF–c	21	15	4	1	0	41	4.37	0.76	10.13	3
BF–d	19	17	5	0	0	41	4.34	0.68	10.68	2
BF–e	6	22	12	1	0	41	3.80	0.71	9.19	6
BF–f	8	23	7	2	1	41	3.85	0.87	8.28	8
BF–g	10	22	6	3	0	41	3.95	0.82	8.74	7
BF–h	12	22	5	2	0	41	4.07	0.78	9.31	5
BF–i	21	14	4	2	0	41	4.32	0.84	9.46	4

the analysis of these responses are presented and discussed under the four main sections: Demographics; Benefits of having an EMS; Barriers to having an EMS; and Implementation strategies for having an EMS.

4.1 Demographics

Most respondents to the survey were architects, directors and engineers (34.1%, 24.4% and 12.2%, respectively) based in consultant, design, contractor and sub-contractor construction firms. In terms of experience, most respondents (58.5%) had at least 5-years construction industry experience in the Maldives.

4.2 Benefits of having an environmental management systems

The questionnaire listed nine factors considered to be advantages to organisations in the construction industry (Table 4). Analysis of the questionnaire responses (Table 5) have been used to list the beneficial factors of implementing an EMS in a ranked order of importance (Table 6; Fig. 2).

The results illustrate improving corporate image in environmental performance is perceived to be the most significant benefit in the adoption of EMS in construction practice within the Maldives. This is probably as a result of the competitive nature of the construction sector in area, which is comprised of mainly SMEs contending to gain a competitive

Table 6 List of beneficial factors in ranked order

Rank	Code	Benefit factors
1	BF–b	Improving corporate image in environmental performance
2	BF–d	Contribution to environmental protection
3	BF–c	Contribution to the improvement of public environmental standards
4	BF–i	Reduction of environmental risks-polluted air, lands and water
5	BF–h	Reduction of environment-related sickness and injuries
6	BF–e	Increasing overall business competitiveness
7	BF–g	Improving staff work environment, thus increasing their morale
8	BF–f	Reduction of environmental complaints
9	BF–a	Cost savings due to the reduction of fines associated with convictions

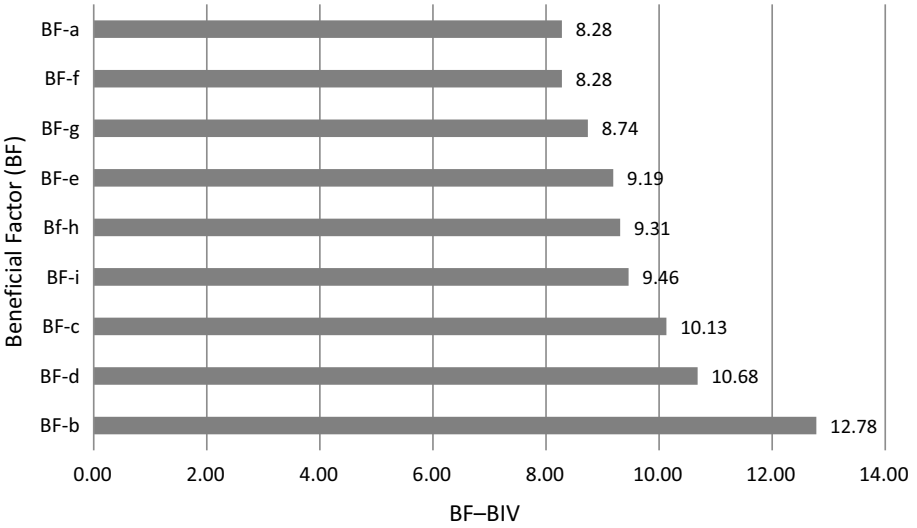

Fig. 2 Ranking profile of beneficial factors to the implementation of EMS

advantage in the industry. A similar outcome was observed in a study conducted in China, to analyse the benefits of implementing the ISO 14000 standards. It was suggested that ISO certified organisations were likely to be regarded as more competent due to the international recognition of the standard; hence, improving the corporate image and credibility of the organisation (Tam, 2008). Likewise, even in developed countries, such as the Sweden and Hong Kong, the enhancement of corporate image was cited as a significant motive and benefit of adopting an EMS (Horry et al., 2022; Poksinska et al., 2003; Shen & Tam, 2002).

The contribution to environmental protection was perceived to be the second most significant benefit. This perception would link to the increased focus on environmental issues in Maldives in recent years, including achieving carbon neutrality by 2020 (UNFCCC and Ministry of Housing and Environment, 2010). Additionally, stakeholders are becoming more aware of the impact of construction activities on the environment, such as pollution of air and water resources, generation of substantial waste quantities and consumption of

renewable and non-renewable energy sources and material (Zhang et al., 2000). This result resonates with the findings in both Hong Kong (Shen & Tam, 2002) and Nigeria (Owolana & Booth, 2016), where contribution to environmental protection was identified as one of the most significant benefits of implementing an EMS in construction (Bailey et al., 2020).

The research findings interesting cite cost savings due to the reduction of fines associated with convictions was deemed the least significant benefit. This is probably due to the absence until recently of any construction law in the Maldives, and hence, there have not been any legislative frameworks to regulate the industry. Thus, until now organisations have rarely been held accountable for the impacts of their construction activities. Similar to the situation in Nigeria, reported by Owolana and Booth (2016), where environmental management is not accounted for in the tendering requirements and construction procurement is largely aimed at securing the lowest bid. Hence, the participants are less likely to expect cost savings associated with environmental convictions.

The reduction of environmental complaints was found to be the next least significant benefit. This finding can also be seen to relate to the lack of government legislations and legal frameworks to govern the industry, limiting the avenues that could be used in raising environmental complaints by third parties. Additionally, the lack of legal frameworks in the country has contributed to the diminished transparency in dealing with environmental complaints that are lodged by concerned parties. Thus, this result signifies the importance of establishing open dialogue between the different levels of the government, as well as external stakeholders such as educational institutes, research bodies and the civil society (Du Plessis, 2007). The case study in Nigeria, also a developing country, shows similarities to the Maldives relating to the political sphere and corruptive practices, and a lack of concern for the implementation of standards and policies in environmental management (Owolana & Booth, 2016). However, if consideration is given to Hong Kong, a more developed country, the reduction of environmental complaints was ranked as a more significant beneficial factor, indicating the presence of appropriate channels for lodging complaints and raising concerns (Shen & Tam, 2002).

4.3 Barriers to having an environmental management systems

The questionnaire listed thirteen factors considered to be challenges to organisations in the construction industry (Table 7). Analysis of the questionnaire responses (Table 8) have been used to list the barrier factors of implementing an EMS in a ranked order of importance (Table 9; Fig. 3).

The research findings reveal the most significant barrier to implementing an EMS in the Maldives is the lack legal enforcement. This result reflects the lack of a well-structured and effective legislative framework to regulate the construction industry, a case common to most developing countries (Hortensius & Barthel, 1997; Owolana & Booth, 2016; Tam, 2008).

The government could lead efforts to promote and encourage environmental management practices in the country, by improving the legal framework and developing the required infrastructure for formal environmental management practices within the industry. Additionally, financial incentive schemes administered by the government may trigger widespread adoption of EMSs in the country (Davy, 1997; Ofori et al., 2002). However, Liyin et al., (2006) remarked that government efforts alone would be insufficient to drive the environmental management agenda, unless organisations are internally motivated and committed to such practices. As noted in research from Hong Kong a lack of legal

Table 7 List of barrier factors

Code	Strategy Factors
EB–a	Lack of government legal enforcement
EB–b	Increase in management and operation cost
EB–c	Lack of trained staff and expertise
EB–d	Lack of client support
EB–e	Lack of sub-contractor cooperation
EB–f	Lack of supplier cooperation
EB–g	Difficult coordination of environmental performance among multi-tier subcontractors
EB–h	Lack of working staff support
EB–i	Time consuming for improving environmental performance
EB–j	Change of existing practice of company structure and policy
EB–k	Increase in documentation workload
EB–l	Lack of tailor-made training on environmental management
EB–m	Lack of technological support within organisation

Table 8 Survey responses and calculation of parameter values to barrier factors

Code	SA	A	N	D	SD	Total	WAS	δ	EB–BIV	Rank
EB–a	23	13	3	1	1	41	4.37	0.90	9.19	1
EB–b	11	19	6	5	0	41	3.88	7.99	7.99	6
EB–c	15	17	5	4	0	41	4.05	8.38	8.38	3
EB–d	7	16	13	4	1	41	3.56	7.26	7.26	8
EB–e	5	18	5	12	1	41	3.34	6.39	6.39	12
EB–f	2	16	7	15	1	41	3.07	6.08	6.08	13
EB–g	6	22	9	3	1	41	3.71	7.87	7.87	7
EB–h	4	18	8	10	1	41	3.34	6.60	6.60	11
EB–i	8	18	7	6	2	41	3.59	6.83	6.83	9
EB–j	8	18	14	1	0	41	3.80	8.73	8.73	2
EB–k	6	14	15	4	2	41	3.44	6.83	6.83	9
EB–l	13	21	3	3	1	41	4.02	8.26	8.26	4
EB–m	17	15	4	5	0	41	4.07	8.16	8.16	5

enforcement was perceived as one of the least significant barriers to the uptake of EMS in the construction sector. It was suggested that while organisations acknowledged the impacts of legislative measures, at the same time, regarded them as being excessive and overemphasised (Shen & Tam, 2002).

Changes of existing company structure, policy and the lack of trained staff and expertise were also found to be significant obstacles to the implementation of EMS in the Maldives. This finding signifies the reluctance of the industry to change their organisational structure, which stems from top management commitment to the subject. Shaheen and Charoenngnam (2004) suggests industry in the Maldives is still in its infancy in understanding the concept of sustainable construction, demonstrating similarities to a case study from Egypt (Sakr et al., 2010) and so their hesitancy to restructure the organisational policies to include environmental management components is justifiable. However, top management commitment has proven to be a crucial factor in the implementation, as well as in the improvement

Table 9 List of barrier factors in ranked order

Rank	Code	Strategy Factors
1	EB–a	Lack of government legal enforcement
2	EB–j	Change of existing practice of company structure and policy
3	EB–c	Lack of trained staff and expertise
4	EB–l	Lack of tailor-made training on environmental management
5	EB–m	Lack of technological support within organisation
6	EB–b	Increase in management and operation cost
7	EB–g	Difficult coordination of environmental performance among multi-tier subcontractors
8	EB–d	Lack of client support
9	EB–i	Time consuming for improving environmental performance
9	EB–k	Increase in documentation workload
11	EB–h	Lack of working staff support
12	EB–e	Lack of sub-contractor cooperation
13	EB–f	Lack of supplier cooperation

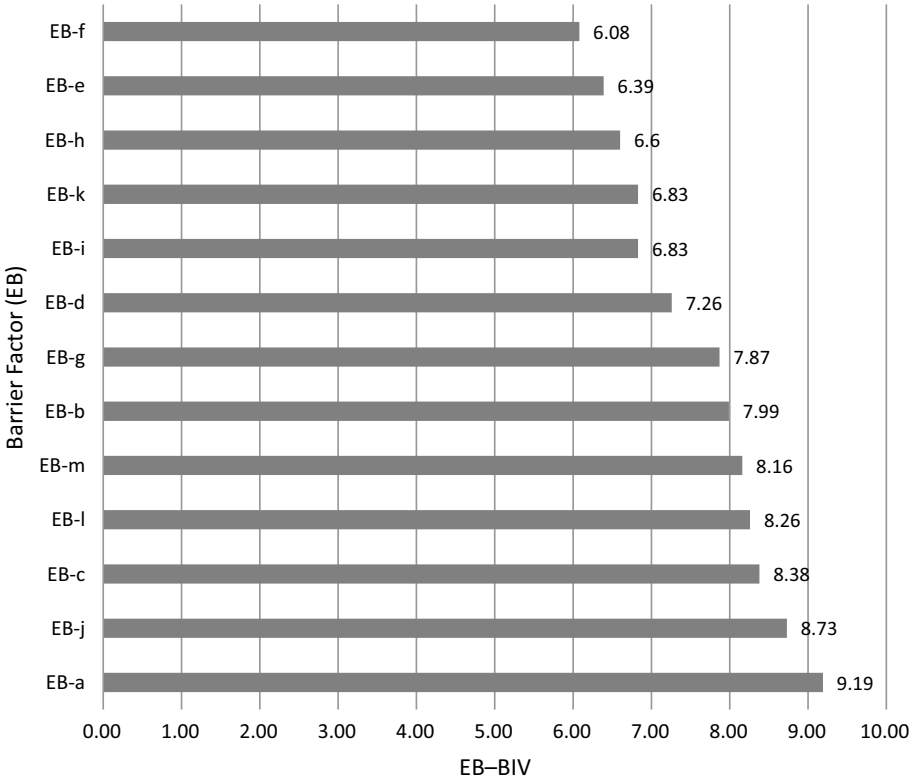

Fig. 3 Ranking profile of barrier factors to the implementation of EMS

of an EMS in an organisation (Ejdys et al., 2016). Furthermore, the two aforementioned factors are closely related, as organisations often lacks the human resources required to restructure organisational frameworks to accommodate environmental management measures; a challenge more likely to be encountered by SMEs (Hillary, 2004). Additionally, construction firms in the Maldives are primarily driven by short-term cost savings, similar to a case study in Hong Kong (Shen & Tam, 2002), and hence, are less likely to consider the potential benefits of investing in staff training or employing subject experts.

The research findings also indicate lack of supplier and sub-contractor cooperation were the least important barriers in the uptake of environmental management within the industry. This result is rooted in the fragmented nature of the relationship that exists between the supply chain and the construction organisations in the Maldives, the former is often perceived to be less influential than the latter. A similar outcome was observed in the study undertaken in Nigeria (Owolana & Booth, 2016) indicating that issues with the supply chain are typically considered to be minor barriers in developing countries. In contrast, a case study in Hong Kong revealed subcontractor cooperation was a major barrier, as main contractors were challenged with regulating the environmental performance of their supply chain (Shen & Tam, 2002).

Lack of support of working staff was also observed to be a less significant barrier to the adoption of EMSs in the Maldives. This is due to the top–down management approach that is still prevalent within construction organisations in the country, where working staff are designated their roles and responsibilities. This managerial style mirrors the traditional top–down approach used in environmental management, in which environmental policies are implemented and enforced through laws and fines (Barrow, 2005). Hence, the support of the working staff is expected, regardless of the organisations' decision to adopt environmental management practices.

4.4 Implementation strategies for having an environmental management systems

The questionnaire listed ten factors considered to be organisational implementation strategies for an EMS in the construction industry (Table 10). Analysis of the questionnaire responses (Table 11) have been used to list the strategy factors of implementing an EMS in a ranked order of importance (Table 12; Fig. 4).

Table 10 List of strategy factors

Code	Strategy Factors
EM–a	Legal requirements on environmental protection
EM–b	Reduction, reuse and recycling of construction and demolition wastes
EM–c	Imposing responsibilities of protecting environment on managerial staff
EM–d	Applying environmentally friendly technology on site
EM–e	Providing in–house training on environmental management
EM–f	Establishing waste management plan
EM–g	Continuous efforts in improving environmental management
EM–h	Inclusion of environmental management in tendering requirements
EM–i	Effective communication of environmental issues between all layers of subcontractors
EM–j	Close supervision at site level

Table 11 Survey responses and calculation of parameter values to strategy factors

Code	SA	A	N	D	SD	Total	WAS	δ	EM–BIV	Rank
EM–a	26	11	4	0	0	41	4.54	0.67	11.35	2
EM–b	19	16	2	2	2	41	4.17	1.06	8.12	9
EM–c	15	19	6	1	0	41	4.17	0.76	9.64	6
EM–d	14	22	3	2	0	41	4.17	0.76	9.64	6
EM–e	13	24	2	2	0	41	4.17	0.73	9.89	5
EM–f	24	14	3	0	0	41	4.51	0.63	11.68	1
EM–g	22	17	0	2	0	41	4.44	0.73	10.49	3
EM–h	23	12	5	1	0	41	4.39	0.79	9.93	4
EM–i	14	18	6	2	0	41	4.10	0.83	9.04	8
EM–j	16	20	2	3	0	41	4.20	0.83	9.23	7

Table 12 List of strategy factors in ranked order

Rank	Code	Strategy Factors
1	EM–f	Establishing waste management plan
2	EM–a	Legal requirements on environmental protection
3	EM–g	Continuous efforts in improving environmental management
4	EM–h	Inclusion of environmental management in tendering requirements
5	EM–e	Providing in–house training on environmental management
6	EM–c	Imposing responsibilities of protecting environment on managerial staff
6	EM–d	Applying environmentally friendly technology on site
8	EM–j	Close supervision at site level
9	EM–i	Effective communication of environmental issues between all layers of subcontractors
10	EM–b	Reduction, reuse and recycling of construction and demolition wastes

The findings of this study demonstrate establishing a waste management plan is considered as the most significant strategy towards implementing environmental management in the Maldivian construction sector. This is probably because construction and demolition waste accounts for nearly 30% of total waste generated within the country, a figure comparable to many developed nations (Pucino, 2016; Tam, 2008). Thus, effective waste management is increasingly recognised as a critical aspect of construction project management, as most of the construction waste tends to end up in landfills, which subsequently results in pollution of the biosphere (Alwan et al., 2017; Tam, 2008). In the Maldives, until recently, the entire island of Thilafushi was used as a waste disposal site on which untreated waste was burnt and construction debris was used to infill the lagoon (Hassan & Peterson, 2016; Medina, 2012). This type of activity will negatively impact on the tourism industry therefore, it is essential that the construction sector established suitable waste management plans. This will encourage the implementation of environmental management systems in the construction industry, as studies in Latvia and Nigeria have illustrated that EMS' can drastically improve waste management efforts on construction sites (Owolana & Booth, 2016; Tambovceva & Geipele, 2011). Additionally, Rodríguez et al. (2011) pointed that construction and demolition waste is generally not included in technical specifications and is not budgeted for;

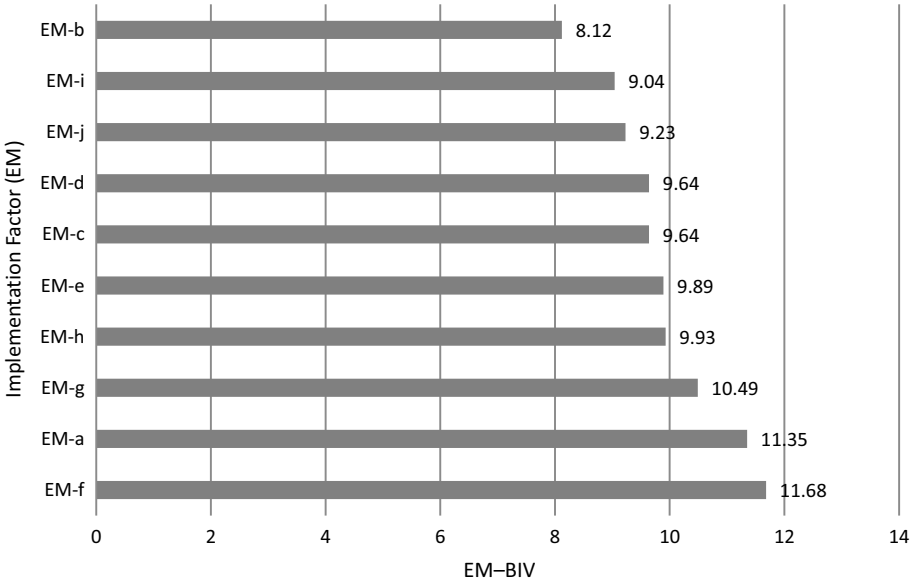

Fig. 4 Ranking profile of implementation measures to EMS

hence, the implementation of an EMS would result in significant savings as shown in a study on the mining industry in Ghana (Fei-Baffoe et al., 2013).

Legal requirements on environmental protection were also identified as a critical strategy that can be employed in driving environmental management efforts in the Maldives. This outcome is reasonable, as the lack of government legislation was perceived to be the most significant barrier to environmental management, a typical situation in developing countries (Owolana & Booth, 2016). Barrow (2005) stated that developing countries with limited financial resources, such as the Maldives, are more likely to implement environmental management standards to satisfy aid donors or conform to legal regulations.

The study outcomes illustrate that the reduce–reuse–recycle strategy of construction and demolition waste was perceived to be less relevant in strategic terms for promoting the uptake of EMSs in construction organisations. This is linked to the absence of a formal recycling agenda administered by the government, as well as levels of awareness among the general public on the reduce–reuse–recycle strategy (Pucino, 2016). Recycling is a challenge due to the limited technological resources and infrastructure in the country, similar to the circumstances present in Nigeria (Owolana & Booth, 2016).

Effective communication of environmental issues between all layers of subcontractors was regarded as a less significant strategy by construction professionals in the Maldives. This outcome is associated with the fragmented nature of the construction industry in the Maldives, in which the subcontractors wield less influence over the main contractors and designers. Moreover, the construction industry in the country is still characterised by hostile relationships between main contractors and the supply chain. Hence, communication efforts between the subcontractors would be less effective, than strengthening the influence of the main contractors in the industry.

5 Conclusions

This study makes a distinct contribution to knowledge by responding to a research gap at the interface of environmental management systems and the Maldivian construction sector. It provides an insight into the uptake of EMS within the industry in the Maldives and discusses the benefits and barriers to implementing EMS as perceived by the industry stakeholders.

The findings of the study reveal that the main motivation for construction organisations in Maldives to adopt environmental management standards is to strengthen their corporate image and increase their competitiveness in the market. A formal environmental management certification, such as the ISO 14001, is perceived to be linked to the credibility of the organisation. Further, industry professionals believe environmental management systems would contribute positively to the protection of natural environment—a perception which stems from the increasing awareness on environmental issues in Maldives in recent years.

The main barrier to the uptake of EMSs in the Maldivian construction industry was identified as the lack of government legal enforcement. Without a legislative framework to regulate the industry, organisations were less likely to adopt environmental management standards voluntarily. Hence, it signifies that government-led efforts to encourage environmental management practices and to introduce financial incentives are critical in the context of the Maldivian construction industry. The change of existing company structure and lack of trained staff and expertise were also recognised as significant obstacles, likely due to the associated cost implications and human resource limitations.

The research results also indicated the significance of establishing a waste management plan to drive the environmental management agenda in the Maldives. Construction waste is generally not accounted for in technical specifications of projects; hence organisations would be more likely to opt for waste management options incurring the least expense, not necessarily the most effective. The results also highlighted the need for legal requirements on environmental protection, which reflects the perception that the lack of legal enforcement is the key barrier to the adoption of EMSs in Maldives.

This research study has provided an insight into the construction industry of the Maldives, with regards to environmental management practices. While the number of responses was only 41 this is considered sufficient in comparison to other similar studies within developing nations. A limitation of the research is that it does not identify the opportunities for improvement in the situation from the perspective of this group of professionals. However, what it does provide are the primary benefits, perceived to be the key drivers in stimulating environmental management in construction organisations. It has also emphasised the barriers, which must be addressed both by the government, as well as by the industry stakeholders, to improve the environmental impacts due to construction activities in the Maldives. Lastly, the research has been crucial to the formulation of strategies that could be implemented to enhance the adoption of EMSs in construction practice.

Based on the conclusions it is proposed that:

1. Environmental managers, or those managers with any environmental responsibility, need to be more active in promoting the principles of environmental management and increasing awareness of sustainable practices and behaviours amongst construction industry stakeholders.
2. Due to the nature of the construction industry in the Maldives in that it is top–down in nature, education of the top–management about the environment is crucial to ensuring

real commitment at managerial level to addressing environmental issues in the Maldivian construction sector. Research is needed in this area, to gain an understanding of their perspectives.

3. Environmental Managers within construction organisations also have a responsibility to ensure necessary guidelines and practical benchmarks are incorporated into any formal EMS, and they should encourage continuous monitoring of the system for maximum effectiveness. Environmental Managers should also play a key role in lobbying for legislative standards for environmental performance within the industry.
4. Policymakers hold a moral obligation to the public, to ensure that they are protected from the harmful impacts of economic activities such as construction. In the case of the Maldives, policymakers are critical to ensuring construction organisations conform to environmental standards. Thus, creating legislation and setting up enforcement structures are primary responsibilities of Policymakers. Research into the views of policy makers would encourage this process.
5. Research into the viability of establishing financial incentive schemes, particularly for SMEs to encourage wider adoption of EMSs within the industry, is needed.
6. Future research should also focus on studying the relationship between waste management, which emerged as the top issue, and the reduction, reuse and recycling of construction waste, which was ranked as the least effective. This would permit an understanding of how best the reduce–reuse–recycle strategy can be incorporated into waste management plans of Maldivian construction organisations.

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Data availability The data are contained within this article.

Declarations

Conflict of interest The authors declare no conflicts of interest.

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