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Measures of greenness: An empirical study in service supply chains in the UAE

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ABSTRACT

Research in the field of green supply chains has recently gained attention in the developing world. This area is equally important for both practitioners and academics. Studies in the environmental sustainability field have predominantly addressed the carbon footprint concerning stakeholders in the production/manufacturing industries. However, they lack a comprehensive and tangible description of greenness. So, this research contributes to the literature on sustainable supply chains by identifying the factors involved in greening a supply network (both upstream and downstream). This paper focuses on exploring the indicators of greenness to develop a framework of related indicators in modern businesses. A comprehensive scale is developed and empirically validated to measure the extent of greenness in service industries in the United Arab Emirates (UAE). Based on interviews and survey results in the UAE service industry, the results indicate that greenness in a service supply chain has six underlying dimensions: “managing operations,” “reducing resource requirements,” “building eco-friendly infrastructures,” “green computing,” “avoiding risks and uncertainties,” and “monitoring utilities.” Identifying the indicators of greenness can help bridge the existing gaps in the literature and help to make green service supply chains in the UAE a reality. The research provides several implications for researchers and practitioners, as well as highlights areas for potential future research. This paper is the first to combine stakeholder theory and the natural resource-based view in the literature on greenness.

1. Introduction

Greenness in a supply chain relates to issues of sustainability and wellbeing in society. Given the current enhanced level of awareness regarding the scarcity of resources against the backdrop of ever-increasing demand, the concern is growing about whether the next generation will be able to meet its own needs and wants. Several sections of society have become increasingly conscious of resource depletion and how to satisfy their needs with minimal usage of these resources. This awareness, encompassed by the term “green,” not only requires organizations to adhere to relevant regulations but can also help them cut production costs (Gollan et al., 2001). In essence, supply chains are trying hard to maximize customer value for their products and services. Maximizing customer value entails attaining a sustainable competitive edge in planning and controlling all operations related to sourcing, procurement, production, transportation, logistics, and customer care. Therefore, modern industries are keener than ever to use resources and minimize their environmental footprint efficiently.

Modern industries are addressing this challenge by integrating environmental concerns into their organizational practices. This new approach has been termed green supply chain management (GSCM) (Sarkis et al., 2011). This concept applies both to manufacturing and service supply chains that strive to achieve targets about social, environmental, and economic responsibilities, i.e., the triple bottom line of sustainability (Diaz-Balteiro et al., 2017). Notably, however, green practices can also be a source of competitive advantage for service supply chains (Stylos and Vassiliadis, 2015).

GSCM practices can greatly help organizations overcome sustainability issues and achieve success based on standards such as the triple bottom line of sustainability (Diaz-Balteiro et al., 2017). Given that the activities of some manufacturing organizations in some of the world’s most under-developed regions result in toxic emissions that pollute the

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environment, comprehensive standards are required to manage industries' environmental, political, technological, and social responsibilities.

1.1. Purpose and significance

Greenness is the integration of environmental considerations with the inter-business operations of a supply chain (Zhou et al., 2018). This concept applies to every economic sector, in manufacturing and services, and contributes to sustainability development (Gibbs et al., 2017). Greenness is directly connected to green initiatives and green business procedures; however, their recognition and evaluation require an organized and systematic approach (Zhou et al., 2018). The literature lacks a comprehensive theoretical and conceptual assessment of frameworks that cover an entire supply chain. This paper aims to explore factors that drive a service supply chain's decision to focus on integrating greenness into their tangible performance outcomes concerning sustainability.

The United Arab Emirates (UAE) has set itself on a course to becoming a globally recognized center for commerce. In pursuing this goal, the country is exploring all viable options to adapt to the new realities of global business sustainably. Industrial- and service-based firms in the country are embracing the challenges of improving efficiency and reducing waste as an opportunity to better understand and embrace the green phenomenon (Ghazaleh et al., 2019).

However, the subject of greenness is still in its infancy in the UAE because of the level of awareness among business ventures (Balasubramanian and Shukla, 2017), although some organizations in the country have begun to appreciate the benefits of realigning their practices with sustainability standards (Al-Aomar and Hussain, 2017). This paper aims to understand the existing efforts about greenness in the supply chain in various service industries in the UAE. The proposed framework is developed based on three aspects of green management (awareness, know-how, and implementation), and each aspect is further investigated through specific research questions. This would contribute to the body of knowledge in the service sector regarding green parameters within their supply chains. Thus, the paper contributes to the literature by:

- extending the knowledge base on green services by exploring the antecedents in the UAE
- bringing together the notion of stakeholder theory and natural resource-based view by developing and validating a scale for green services
- validating the relationship between green practices in service supply chains empirically; and
- empirically testing the impact of green practices on overall greenness in service supply chains.

It should be noticed that this paper attempts to extend the line of research in Chan et al. (2016) that conceptualized and developed one of the first constructs for green services from the viewpoint of environmental management. They highlighted the role of macro-level factors such as promotion, product design, corporate policy, and after-sale activities in greening a service. While Chan et al. (2016) covered the subject from a broader and global perspective, this paper takes a microscopic 'process view' to identify the antecedents of green service. This effort has resulted in indicators pertaining to operations, resource requirements, infrastructure, uncertainties, and utilities, etc.

A group of supply chain professionals helped in developing the concept and scope, and thus a measurement scale for greenness in service supply chains. The survey results provide answers to the study research questions, while the study findings offer guidance and insight for green assessment in industry, specifically in the UAE context. Identifying the indicators of greenness help to bridge existing gaps related to making green service supply chains in the UAE a reality. The remainder of the paper is organized as follows. Section 2 comprises a literature review of research relevant to this study. Section 3 details the study's theoretical background, while section 4 describes the methodology. Section 5 presents and analyses the results. A discussion of the results and implications for research and practice is provided in section 6, and the paper concludes with limitations and future research directions in section 7.

2. Literature review and theoretical background

Continuous economic development and increased global competition have led to the service industry becoming more prominent at the international level (Zhao et al., 2019), resulting in almost all developed countries shifting towards service-based economies. Service industries have become a significant contributor to the GDP not only of developed countries but also of developing ones. However, over the last few decades, the impacts of business operations on the environment have become increasingly apparent, as evidenced by increased pollution, depleted resources, and global warming (Amran et al., 2016). Despite the increased involvement of the service sector in many economies, the resultant environmental impact has, however, mostly passed unnoticed due to their indirect impact. Therefore, concerns regarding environmental sustainability in the service industry have remained a low priority (Chan et al., 2016; Abdullah et al., 2017).

2.1. Environmental protection

In recent times, organizational stakeholders are paying additional attention to environmental protection (Chen et al., 2015). The paucity of natural resources and amplified toxic wastes in metropolitan atmospheres, and climate change have augmented the anxiety about its ecological impacts on business practices (Gopalakrishnan et al., 2012). It has turned out to be a fast-developing movement for companies to tag their products or services as ecologically friendly (Sellitto, 2018). In global dynamic sectors, firms must be well-informed and well-equipped to retain and magnify their green business operations (Lin and Chen, 2016). Since ecological accountability has just emerged as a key concern, customers are eager to choose and pay for eco-friendly services (Kumar, 2020).

2.2. Green value chain

Green value chain practices are reflected to be a significant part of organizational greening (Sambhanthan and Potdar, 2015). So, it is a prerequisite for organizations to integrate ecological practices into their value chain activities to accomplish greater economic-environment paybacks (Mangla et al., 2013; Sellitto, 2018). Key green business value chain practices consist of green purchasing, greenhouse gasses alleviation, green logistical arrangements, safe disposal, green product design, and classic actions of reverse logistics, like recycling leading to circularity (Raut et al., 2019). The effect of green service can be measured through gas emissions, discharges, waste generation, usage of natural and energy means, and impact on wildlife (Sellitto et al., 2012). The usage of raw constituents, wrapping, energy, maritime, earth, forests, natural means, inventory process, and shipping are instances of ecological effects, which must be considered for a green value chain. Furthermore, lean operations can be supportive of greening service operations (Yang et al., 2011; Al-Aomar and Weriakat, 2012).

Novel environment-friendly green services are now set forth as a key tool to realize sustainable organizational performance (Sangle, 2011). Green service innovation can ominously turn into the standard in environment-friendly services and maintain great attractiveness, consequently sustaining a firm's competitive advantage (Lin and Chen, 2016). But, most service companies are not equipped to elucidate environmental concerns (Paulraj, 2009) and must create green instruments to advance green knowledge and resolve environmental issues

(Vanalle et al., 2017). Green should not be just a marketing tactic but must cogitate the fundamental part of green value chain activities with service innovation and dynamic capabilities (Lin and Chen, 2016).

2.3. Green strategies

The realization of green strategies in service firms has been diligently associated with the ethical ideologies of the corporate leaders (Parry, 2012), and the ethical values of the proprietor–administrator seems to be the core inspiration driving concrete green practices in their value chains (Parisi and Maraghini, 2010). Also, individual and circumstantial settings are significant green decision-making elements (Cordano et al., 2010). Especially, the levels of accountability and consciousness about the company's ecological effect have a straight linkage with green business services (Allen and Malin 2008).

Organizational support is considered as a major factor for the adoption of green service policy (Sureeyatanapas et al., 2018), and top management should have the capability and capacity to assign required means to green practices, to encourage and inspire employees' responsiveness to green practices, in addition to institute allied policies and strategies (Ojo et al., 2014; He et al., 2017). Effective execution of green practices also necessitates employees' training and communication programs (Lai and Wong, 2012; Maas et al., 2014). Moreover, as performance monitoring is essential for enhancement, executives should be able to recognize fragile extents in value chains and motivate their crews to uninterruptedly streamline the green processes (Dou et al., 2018).

Green services mandate a novel approach that will let the firms to get advantage by refining their environmental performance (Ravell and Blackburn 2007; Malik et al., 2016). Green services should be focused on monitoring the methods of service delivery and support to curtail the intake and waste of resources whereas removing the consumption of ecologically damaging resources and tools from service operations (Wong et al., 2013). The goal is to promote the conservation of resources and the use of environmentally friendly materials, recycled materials, and energy-efficient machinery in service operations. Furthermore, through the reduction of the adversarial environmental effect of service provision, green service practices are commonly linked to firms' strategic framework and rooted in business processes (Guyader et al., 2019). Green services provide benefits not merely to the principal firm but also the network actors (Kumar, 2020) but within given inadequate resources and capabilities, the implementation of green processes in the value chains brings challenges for strategic decision-making and flexibility (Liu et al., 2019).

2.4. Theoretical background for green services

The natural resource-based view (N-RBV) theory is an addition to the resource-based view (RBV) theory that features firm performance enhancement with valuable resource, capability, and value chain activities that are socially multifaceted and casually ambiguous (Barney, 1991). Value chain activities that exploit firm resources (tangible and intangible) and capabilities are the potential basis of competitive advantage as services are vital owing to their intangibility and complexity in being copied (Wong et al., 2013). Green service practices are ecologically accountable value chain activities that exploit tangible assets (materials and machinery) as well as intangible assets (green knowledge/expertise). The N-RBV theory highlights the necessity for capabilities in terms of contamination and wastage prevention (Hart, 1995, 1996). Based on the central principle of N-RBV, actual green service practices must integrate environmental protection concepts into value chain activities by espousing and operating environment-friendly resources, technologies, and materials (Russo and Fouts 1997).

Also, resource integration offers the means for improving competencies used in service to all the stakeholders (Lusch and Vargo, 2014). Resource integration also builds new potential dynamic capabilities for additional value co-creation (Guyader et al., 2019). Resource integration is organized by a constant sequence of activities (Payne et al., 2008) and with the integrative practices of cooperating, collaborating or liaising, and experiencing among stakeholders in a service ecosystem (Edvardsson et al., 2014). In a service ecosystem, actors share an identical drive of exploiting value creation with the best matching of resources, capabilities, and procedures in such a way that resources combinations turn out to be valuable when they are harmonized and positioned within a resource-based value creation network (Gummesson and Mele, 2010).

On the other hand, stakeholder theory (Jones et al., 2017) posits that the goals and objectives of an organization affect, and are affected by, many groups that are not shareholders (see Fig. 2). These groups impose different levels of pressure on the organization to assume greener practices. Organizations must keep their activities in line with stakeholders' expectations as several firms in their downstream and upstream supply chains may have a different level of investment in green practices (How et al., 2019).

Moreover, several facilitating factors help businesses implementing green practices to be more successful, such as management dedication, strategic planning with suppliers, and investment in employee training. Here, information technology infrastructure catalyzes the effective communication of firms with their suppliers.

Stakeholder theory also highlights the role of other core aspects in the implementation of green practices, such as government assistance, organizational capacity, ethical standards, and corporate social responsibility (Xiao et al., 2018). Fig. 1 depicts how the two theories together lead to the notion of greenness.

3. Hypotheses and model development

3.1. Managing operations

The general awareness with regards to environmental sustainability and related issues, nonetheless, is pushing all businesses to reconsider their business operations, such as facility planning, inventory management, demand forecasting, distribution, and logistics. Accordingly, service providers are facing increased pressure to adjust their services to keep up with the competition in the market and the environmental impacts that result from their operations (Dangelico and Pujari, 2010). The adaptation of environmentally friendly practices and greening processes, through research, has proved to have a positive impact on the performance of service providers. The benefits of adopting green practices are evident in the reduced costs, increased flexibility of services, and quality. Hence, due to the popular demand for green practices and the integration of sustainability in business operations, service providers are now greening their practices, yielding better business performance (Verma et al., 2012). For example, green services are linked to financial performance, marketing strategy, customer retention, and environmental performance (Shi et al., 2015).

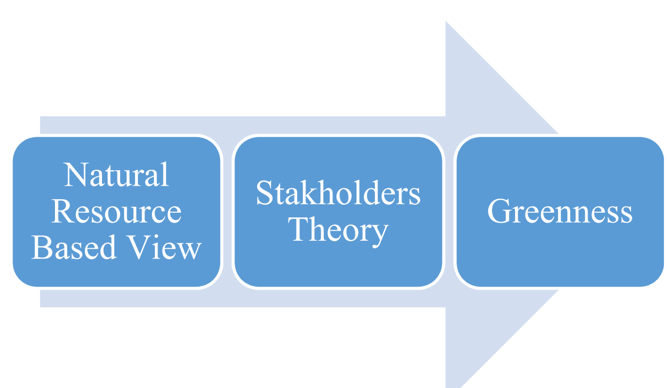

Fig. 1. Theoretical background for greenness in modern business.

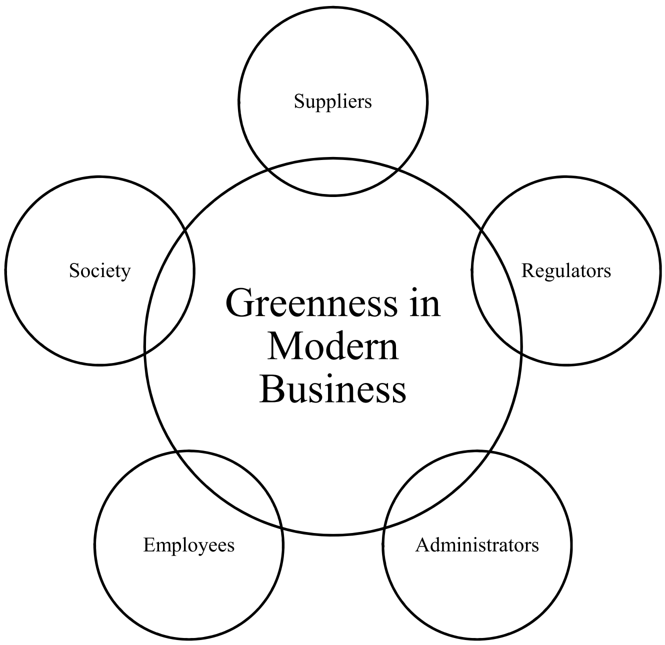

Fig. 2. Stakeholders involved in greening a Firm's business.

In line with RBV, an organization has to be keen on managing its operations for the use of utilities, plastics, synthetics, and the generation of wastes (Eltayeb and Zailani, 2009). This highlights their role in protecting the environment (Malviya and Kant, 2015). Thus, we hypothesize that.

H1. Managing operations have a significant impact on greenness

3.2. Reducing resource requirements

Various components drive the use of resources in organizations, such as their size, sector, level of speculation, and level of collaboration in the supply chain. Maintaining its vital resources plays a significant role in building the success and scope of the business (Pape, 2016). These resources can both be tangible and intangible, such as capital, human resource, knowledge, equipment, and information technology (Hadded et al., 2018).

There has been a shift in many countries from manufacturing toward service-oriented economies (Huang et al., 2019). Studies have shown that the service sector provides opportunities for value creation through greening resources and enhancing supplier-customer interaction. For example, IKEA has adopted green design into its operations (Callaway and Dobrzykowski, 2009). IKEA further incentivizes customers to return some used products such as compact fluorescent light (CFL) bulbs and Christmas trees for proper disposal and recycling, hence co-creating environmental value with their customers.

Moreover, customers are often more interested in the environmental impact of the product rather than the product itself, which calls for greenness to be incorporated into product creation (Pagell and Gobeli, 2009). For example, Carrier has built up an infrastructure of contractors to provide efficient cooling and heating services based on customer requirements. The essence of greenness here is that resources are utilized in innovative ways, and diverse stakeholders are involved in creating new value and providing better services. In another example, Agassi has fostered a network for electric cars in which exchangeable batteries can be conveniently found at roadside stations (Agassi, 2009).

In line with stakeholder's theory, an organization must work closely with the peers upstream and downstream their supply chains to adopt the use of smart and recyclable resources (Li et al., 2019). Therefore, greenness cannot be achieved through a "single target," i.e., natural execution; notwithstanding, firms increasingly understand that this "single target" theory cannot deliver greenness alone (Dubey et al., 2017). Thus, we hypothesize that.

H2. Reducing resource requirements has a significant impact on greenness

3.3. Building eco-friendly infrastructures

The notion of eco-design has been described using different terms, e.g., green design, design for environment, eco-planning, and sustainable design. Eco-design strives to make a sustainable product by incorporating sustainability throughout its life cycle, from procuring raw-material procurement to disposing of a product. Eco-design tries to incorporate sustainability deliberately, or being "natural," into item design while maintaining the utilitarian and wellbeing prerequisites for purchasers (Testa et al., 2016). It likewise stresses the significance of early product-design choices because roughly 80 % of all items with potentially harmful ecological effects can be identified during the design phase of product development.

The industrial sector has had to review its operations concerning greenness to address emerging issues. It is precisely due to this reason that the industry has been keen to establish performance evaluation and management systems. These tools can help assess the progress made and diagnose and continually address emerging problems (Zhou, 2009). It is essential to promote communication among the players to guarantee that effective strategies are formulated to address the issues that a supply chain may be facing. For instance, it may be necessary to implement a performance-evaluation index system, which can help in determining the measures that can be instituted to drive an organization's strategy.

Notably, inter-relationships exist between strategic green orientation, supply-chain coordination, integrated product development, business-unit performance, and green-performance outcomes (Fernando et al., 2019). Hence, organizations are obliged to implement an innovative environment-improvement program. Firms must also consider how future commitment to environmental practices is likely to impact greenness. Enforcing regulatory requirements, social awareness programs, and global standards can assist in making firms review their environmental position. The objective is to ensure that managers are obliged to enact measures that can combat challenges affecting the deployment of greenness (Kabisch, 2015) with environment conservation and resource-saving for future generations (Bai and Sarkis, 2017).

The existing literature suggests a higher value in implementing lean and green practices together. While lean practices are concerned with actions to reduce waste and minimize the consumption of natural resources, green practices are about ensuring that business activities cause no harm to the environment and maintain a consistent level of quality (Cherrafi et al., 2018). The scope of these practices spans from supplier development to employee involvement and customer relationships, e.g., risk-sharing. It has been concluded that a few lean and green practices are non-synergic and that a trade-off exists between them in which more lean activity requires less green activity, e.g., inventory reduction (Chan et al., 2016).

Using the perspective of stakeholder theory, it is imperative for today's supply chains to invest in research and development to help them better allocate their resources and budgets in designing green infrastructures. Regular checks and balances of their compliance help the organizations close to their green targets (Pang et al., 2011). Thus, we hypothesize that.

H3. Building ecofriendly infrastructures has a significant impact on greenness

3.4. Green computing

Green computing is yet another area in which efforts toward greenness are being devoted. Energy consumption in cloud computing has been increasing with demand and usage. As a result, cloud-computing firms, or cloud providers, have been striving to optimize their efficiency to reduce costs and preserve the environment (Qiu et al., 2018). Those efforts, however, are hindered by the presence of cloud service brokerages (CSBs), which serve as intermediate parties between cloud providers (e.g., Microsoft) and the tenants of cloud services (e.g., Dropbox). Profit-driven CSBs often tend to distribute tenants' requests to clouds that do not use resources efficiently to maximize their earnings.

Moreover, in many cases, CSBs are not aware of the electricity consumption of servers in clouds. These issues have led cloud providers to introduce pricing policies that motivate CSBs to conserve cloud energy. This is achieved by enforcing policies that set the price of a server proportional to its energy cost. Incentives for CSBs to allocate tenants' demands to multiple providers in a way that minimizes energy consumption is yet another challenge to be addressed to achieve green computing (Kaur and Sachdeva, 2016).

However, with the rapid growth of the IT industry, the need for a cloud customer base has increased (Chen et al., 2019). The energy consumption and operating costs in cloud services are controlled with autonomic service routing protocols for energy-efficient collaborative cloud architectures. This can be done at both the server and data-center levels (Itani et al., 2015). All the stakeholders, i.e., cloud customers, cloud service providers, the service router, and energy-metric repositories, are responsible for better energy savings and performance (Lin and Lin, 2019). Green computing also entails developing and operating energy-efficient computer systems. Notably, however, most industries continue to use non-renewable sources of energy, which ultimately leads to environmental pollution (Farhan et al., 2018). Therefore, it is essential to determine the steps that can be taken to reduce the consumption of energy.

In line with the resource-based view, a supply chain would benefit from cutting down their use of paper, water, and electricity. A regular cycle of assessment of utility consumption throughout the supply chain ensures that the network is on track for its green targets. Thus, we hypothesize that.

H4. Green computing has a significant impact on greenness

3.5. Avoiding risks and uncertainties

A strategy focused on greenness is a potentially useful differencing factor in organizations operating within the same business segment. Spreading the effect of greenness strategy requires an understanding of the individual factors in each business category that may directly or indirectly lead to a reduced environmental load imposed by the organization's business processes (Odeyale, 2014). One of the processes proposed for the identification and impact evaluation of the factors relevant to an organization is the decision-making trial and evaluation laboratory (DEMATEL) technique (Anand and Parthiban, 2014). The result of this process is a ranking of the factors related to the environmental load, which can be used by the organization for the strategic implementation of greenness. However, its practical implementation requires a comprehensive design encompassing the flow of materials and goods from suppliers, manufacturers, and consumers. The growing concern over the environmental impact of business operations is evident in the customer sentiments relating to companies that are showing compliance with environmental regulations (Börzel and Buzogány, 2019). Thus, greenness integrates environmental regulations into the organizational processes associated with the procurement of raw materials or the distribution of its products (Gurtu et al., 2015).

The success of a green network lies in a firm's ability to avoid risks in various segments such as logistics design, reverse logistics, and lean procurement (Kainuma and Tawara, 2006). In a typical service-based firm, this implies overcoming uncertainties in demand, inventory, and stakeholder relationships. The ability to meet the product demand while consuming fewer resources in terms of raw materials and energy can directly enhance the cost-effectiveness of the business operation. This requires tighter control over wastes such as emissions, energy loss, and the spillage of water. Wastes can also take an intangible form, i.e., errors, delays, and low efficiency (Younis et al., 2016).

In light of stakeholder theory, the partners in the supply chain must be vigilant about the impact of their raw materials and processes on the environment. This calls for a joint effort and investment in exploring ways to control emissions. Thus, we hypothesize that.

H5. Avoiding risks and uncertainties has a significant impact on greenness

3.6. Monitoring utilities

Another implication of greenness on societal norms is the notion of constructing efficient housing schemes and allocating funds for more environment-friendly infrastructures (Madureira and Andresen, 2014). This fosters the culture of creating not only a comfortable but also a safe and favorable environment for society. Reducing the overall cost of utilities benefits all the stakeholders involved, including investors, property owners, developers, planners, and managers of companies (Mapar et al., 2017). This paves the way for:

- promoting green buildings;
- searching for innovative solutions to minimize the impact on the environment;
- reducing operating costs and improving the quality of the working and living environment;
- preserving natural resources; and
- reducing the level of pollution entering the water, soil, and air.

Operating a "green" infrastructure is more economical as it consumes 25 % lesser power, 30 % lesser water and requires lower levels of repair and maintenance. Buildings with such a design are more commonly known as ecological-economic buildings, which provide a low cost of ownership for their entire life cycle (Li et al., 2017).

In line with the resource-based view, modern supply chain networks are constantly thriving to adopt artificial intelligence and digital communication to reduce their carbon footprint. Thus, we hypothesize that.

H6. Monitoring utilities have a significant impact on greenness

4. Research methodology

This paper focuses on exploring the indicators of greenness to develop a framework of related indicators in modern business. Accordingly, this study was divided into five phases, as shown in Fig. 3. In the first phase, the study adopted an exploratory approach to collect empirical data from service organizations in the UAE. A total of 25 administrators and/or experts from five major service industries (banks, healthcare, hospitality, transportation, and energy) in the different emirates of the UAE were interviewed to explore the antecedents of greenness in their organization (Yeung, 2008). Five experts were chosen from each service industry. To cover the entire supply network, experts were selected from the procurement, operations, administration, human resources, and customer relations departments. This broader scope of research is described in Fig. 4. The interviewees were asked to report both the internal and external factors that drive the desire and capability to adopt greenness in their business. Their responses were filtered, in the second phase, into a compiled list of 46 valid indicators of greenness in service supply chains. This output of the qualitative study is shown in the Appendix.

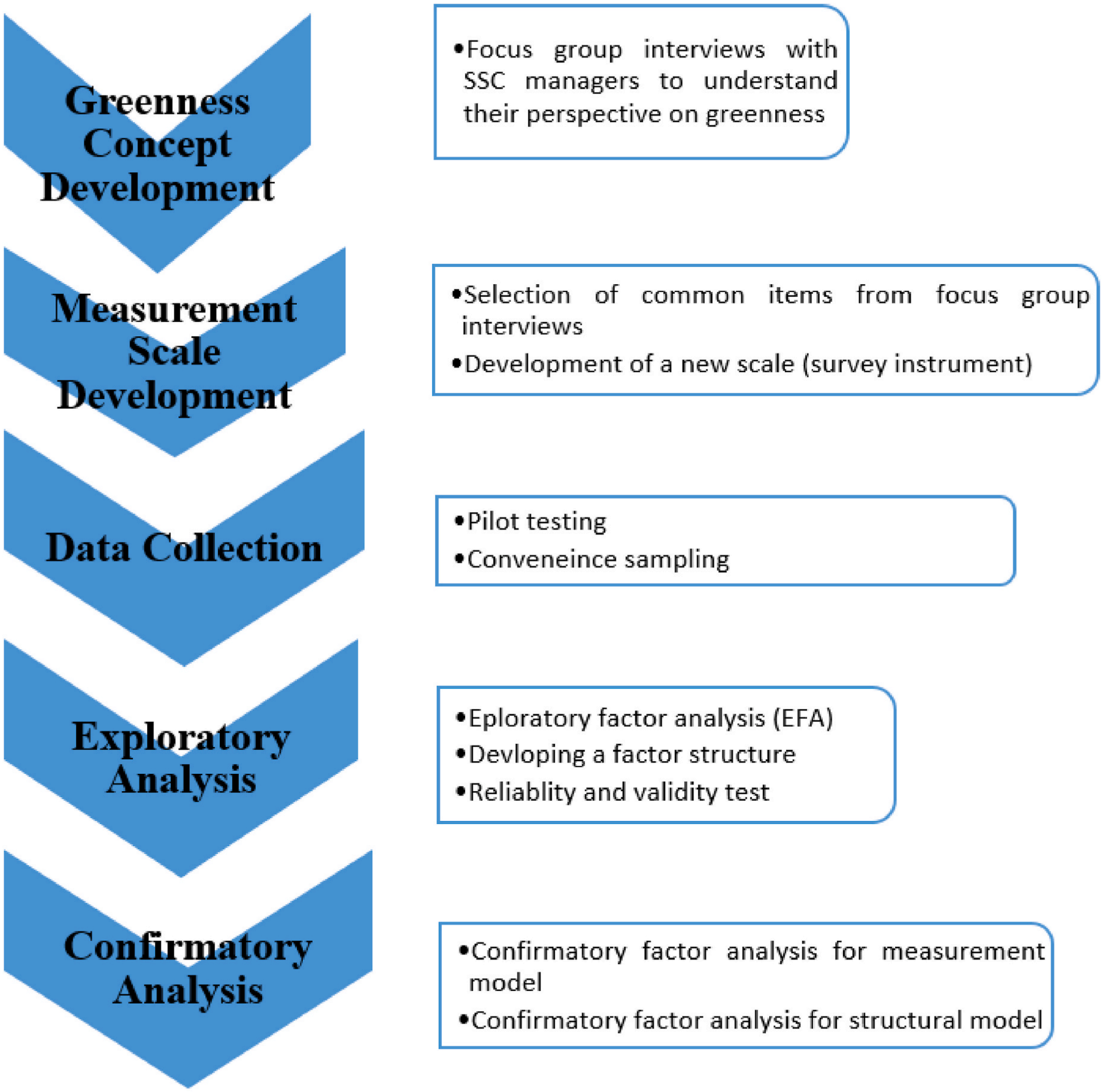

Fig. 3. Multiphase research methodology.

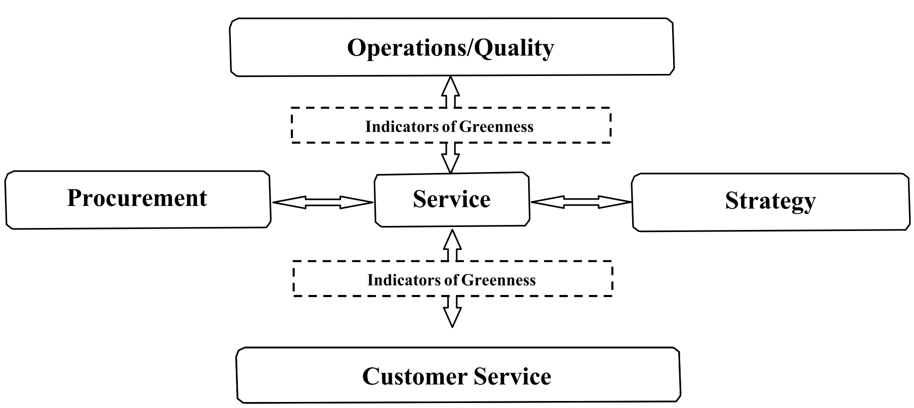

Fig. 4. Scope of research.

5. Analysis

In the second phase, a pilot study was conducted with a group of 20 experts in various service-based firms in the country to test the face validity and readability of the instrument. This helped us improve some phrases in the questionnaire. The questionnaire was then sent to 800 supply-chain professionals. Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy test was used to check if the samples met the minimum specified level. Two indicators (10 and 18) were removed to improve the internal consistency. The results showed enough adequacy for the analysis (0.953).

This instrument was administered through Survey Monkey, and 371 responses were received from procurement, HR, administration, customer service, staff, and other stakeholders in service-based firms across the UAE (Menor and Roth, 2007).

5.1. Demography of respondents and sampling framework

The sampling framework of the study is restricted to managers in the service industry in the UAE, i.e., organizations in hospitality, healthcare, banking, transportation, and water/electricity distribution. Table 1 shows the demography of the respondents. Senior and mid-level managers are believed to know about the strategic position of an organization on the impact of resources on greenness. One can argue that it would be hard to make senior managers respond to a questionnaire due to their busy schedules (Itani et al., 2015). On the other hand, mid-level managers might not perceive this research's importance and tend to ignore our emails. However, Table 1 shows that two-third of the responses were received from mid-level managers. The responses represented a large spectrum of managers from industries in hospitality to healthcare and banks. The "others" category in industries would represent firms working in transportation, water, and electricity distribution (Baruch and Holtom, 2008). Most respondents were from hospitality (49 %), followed by water and healthcare (20 %) and banks (16 %). Besides, most organizations (47 %) had less than 1000 workers there.

5.2. Exploratory factor analysis (EFA)

The fourth phase involved testing these responses. Principle component analysis (PCA) was used to explain the maximum amount of common variance with the smallest number of explanatory constructs (factors or latent variables). These factors represent clusters of the indicators that correlate highly with each other. A Cronbach's alpha (α) value of 0.971 showed that the responses were reliable enough for further analysis. Confirmatory factor analysis (CFA) was used to assess and validate the constructs that describe greenness in the service units.

Several conditions had to be met before testing whether the items were suitable to run the analysis. The tests included the KMO test and Bartlett's test of sphericity. The results are shown in Table 2.

A KMO value of >0.50 shows that items are suitable for the factor analysis; the KMO results showed no problems of serious multicollinearity in the data. Bartlett's test of sphericity ($p < 0.05$) showed that the correlation between items was sufficient to run the factor analysis. After the two tests, EFA was used with a PCA extraction method and Varimax rotation on the 46-item instrument. The number of factors to retain was based on a combination of methods (e.g., eigenvalue >1.0, scree plot) and the theoretical salience of the rotated factors (Stevens, 2012) and loading > 0.4 (Nunnaly, 1978). This procedure resulted in

Table 1
Demography of respondents.

Management Level		Frequency	Percent
	Middle	246	66 %
	Senior	125	34 %
Number of Employees			
	More than 500	175	47 %
	Between 500 and 1000	94	25 %
	Less than 1000	102	27 %
Industry Type	Hospitality	181	49 %
	Healthcare	76	20 %
	Banks	59	16 %
	Others	55	15 %

Table 2
KMO test and Bartlett's test of sphericity.

KMO measure of sampling adequacy		0.952
Bartlett's test of sphericity	Approx. Chi-square	10,074
	Df	946
	Sig	0.000

58.8 % of the variance in the responses.

The factor pattern and item loadings are presented in the rotating matrix component matrix presented in Table 3). The next step was to analyze the content of the questions that loaded highly on the same factor to identify common themes. The questions that loaded highly on factor 1 appeared to relate to different aspects of operations; therefore, this factor was labeled "managing operations." This factor comprised nine items and accounted for 10.90 % of the variance. The questions that loaded highly on factor 2 all appeared to relate to the desire for reducing resources; therefore, this factor was labeled "reducing resource requirements." This factor comprised nine items and accounts for 10.87 % of the variance. The questions that loaded highly on factor 3 all appeared to relate to the desire for eco-friendly infrastructures; therefore, this factor was labeled "building eco-friendly infrastructures." This factor comprised 10 items and accounted for 10.85 % of the variance.

Similarly, the questions that loaded highly on factor 4 all appeared to relate to the use of green computing; therefore, this factor was labeled "green computing." This factor comprised seven items and accounted for 10.07 % of the variance. The questions that loaded highly on factor 5 all appeared to relate to the desire for combatting uncertainties; therefore, this factor was labeled "avoiding risks and uncertainties." This factor comprised eight items and accounted for 9.75 % of the variance. Finally, the three questions that loaded highly on factor 6 related to components of digital monitoring; therefore, this factor was labeled as "monitoring utilities." This factor accounted for 6.36 % of the variance.

5.3. Internal consistency and content validity

The degree of consistency of the responses over a construct is referred to as its reliability. The reliability coefficient, Cronbach's α, is generally used for this test. As shown in Table 3, the Cronbach's α values for the six latent constructs of greenness ranged from 0.755 to 0.908. These results show that the suggested constructs exhibit good psychometric properties.

Convergent validity can be evaluated by the use of the Bentler–Bonett's normed fit index (NFI). This index provides the degree to which the different approaches to measuring a construct generate the same results (Ahire et al., 1996). According to the generally accepted principle, NFI values of 0.90 or above are considered a satisfactory fit index (Bentler, 1992). The fit indices χ^2/dof are below the recommended value of 5; CFI are above the recommended value of 0.90, and RMSEA is below the recommended value of 0.08. Besides, all the loadings of the items about each construct are more than 0.5. Thus, as shown in Table 4, the constructs exhibit acceptable goodness of fit, unidimensionality, and convergent validity for further analysis (Li et al., 2005).

Discriminant validity is the degree to which different latent constructs and their indicators can be distinguished from other constructs and their indicators (Bagozzi et al., 1991). To calculate the discriminant validity, the Cronbach's α value of a latent construct is compared with its mean correlations with other latent constructs. A significant difference between these two measures is an indicator of discriminant validity (Ghiselli et al., 1981). As is shown in Table 4, the five constructs were conceptually distinct.

5.4. Confirmatory factor analysis (CFA)

This is the last phase of our methodology in Fig. 3. The EFA in this research identified "managing operations," "reducing resource

Table 3
Rotated component matrix.

Items		Building Eco-Friendly Infrastructures	Managing Operations	Reducing Resource Requirements	Green Computing	Avoiding Risks and Uncertainties	Monitoring Utilities
43	Implementing regular eco-compliance audit	0.658					
37	Diversifying product functionality	0.596					
40	Investing in research and development	0.561					
35	Allocating budget for green initiatives	0.548					
39	Balancing short-term and long-term objectives	0.547					
41	Ensuring recycle bins around premises	0.536					
38	Following Abu Dhabi 2030 Vision	0.504					
31	Filling trucks with multiple orders/consignments	0.457					
15	Deploying a green monitoring team	0.449					
42	Designing eco-friendly buildings	0.423					
24	Reducing wastage		0.717				
23	Ensuring green-wash for vehicles		0.619				
26	Reducing dependence on synthetics		0.591				
25	Reducing use of plastic		0.535				
13	Reporting opportunities for reducing resource requirements		0.529				
33	Using smart grids		0.521				
27	Using energy efficient air-conditioning		0.516				
5	Rating products on energy consumption		0.491				
21	Enforcing employee self-service			0.631			
19	Reducing defects			0.622			
12	Keeping electronic records			0.604			
22	Pushing for lower utility costs			0.513			
16	Offering online services			0.488			
20	Using e-signatures			0.458			
17	Optimizing operations			0.445			
14	Using refurbished components			0.443			
9	Ensuring minimum environmental impact			0.424			
7	Reducing transportation (internal/external)				0.697		
4	Reducing electricity consumption				0.648		
3	Reducing use of water				0.537		
2	Using solar energy				0.527		
8	Procuring environmentally friendly products				0.481		
6	Implementing green assessment of suppliers				0.464		
1	Reducing use of paper				0.457		
28	Monitoring and regulating emissions					0.706	
29	Ensuring zero flaring to the atmosphere					0.665	
34	Training for GSCM					0.561	
36	Investing in wind energy					0.513	
32	Outlining detailed procedures for re-use and recycling					0.510	
11	Avoiding non-bio-degradable materials					0.493	
30	Using motion-sensitive lights					0.474	
45	Using AI and IOT						0.728
46	Improving digital communication						0.728
44	Reducing CO2 footprint						0.635
Average variance extracted		10.90 %	10.87 %	10.85 %	10.07 %	9.75 %	6.36 %
Construct reliability		0.908	0.888	0.886	0.858	0.868	0.755

requirements," "building eco-friendly infrastructures," "green computing," "avoiding risks and uncertainties," and "monitoring utilities" as a priori factors of greenness in a service unit. In the first-order model, these factors are correlated measurement factors for greenness implementation. Alternatively, greenness implementation may be operationalized as a second-order model, where the six factors are governed by a higher-order factor, i.e., "greenness" implementation. The results of the model estimation are shown in Figs. 5 and 6.

The first-order model for testing greenness (Fig. 5) implies that the six identified factors are correlated but not governed by a common latent factor. Although χ^2 is significant ($p = 0.000$), other fit indices, which are shown in Fig. 5, acceptably support the first-order model for greenness in service facilities (Froehle and Roth, 2004).

The test of the second-order model (Fig. 6) implies that a higher-

Table 4
Construct validity analysis.

	Managing Operations	χ^2/dof	RMSEA	CFI	NFI	$\alpha - Avg\ Corr$	Loadings
		3.11	0.074	0.967	0.953	0.15	
24	Reducing wastage						0.76
23	Ensuring green-wash for vehicles						0.75
26	Reducing dependence on synthetics						0.67
25	Reducing use of plastic						0.75
13	Reporting opportunities for reducing resource requirements						0.69
33	Using smart grids						0.68
27	Using energy efficient air-conditioning						0.72
5	Rating products on energy consumption						0.64
	Reducing resource requirements		RMSEA	CFI	NFI	$\alpha - Avg\ Corr$	Loadings
		3.11	0.075	0.957	0.938	0.14	
19	Reducing defects						0.69
21	Enforcing employee self-service						0.70
12	Keeping electronic records						0.63
22	Pushing for lower utility costs						0.68
16	Offering online services						0.66
14	Using refurbished components						0.72
17	Optimizing operations						0.65
20	Using e-signatures						0.66
9	Ensuring minimum environmental impact						0.71
	Building ecofriendly infrastructures	χ^2/dof	RMSEA	CFI	NFI	$\alpha - Avg\ Corr$	Loadings
		1.68	0.043	0.986	0.966	0.17	
43	Implementing regular eco-compliance audit						0.69
37	Diversifying product functionality						0.75
40	Investing in research and development						0.73
39	Balancing short-term and long-term objectives						0.72
35	Allocating budget for green initiatives						0.72
41	Ensuring recycle bins around premises						0.72
38	Following Abu Dhabi 2030 Vision						0.68
31	Filling trucks with multiple orders/consignments						0.69
15	Deploying a green monitoring team						0.71
42	Designing eco-friendly buildings						0.66
	Green computing	χ^2/dof	RMSEA	CFI	NFI	$\alpha - Avg\ Corr$	Loadings
		2.63	0.066	0.975	0.960	0.12	
7	Reducing transportation (internal/external)						0.64
4	Reducing electricity consumption						0.68
3	Reducing use of water						0.74
2	Using solar energy						0.71
8	Procuring environmentally friendly products						0.66
6	Implementing green assessment of suppliers						0.67
1	Reducing use of paper						0.67
	Avoiding risks and uncertainties	χ^2/dof	RMSEA	CFI	NFI	$\alpha - Avg\ Corr$	Loadings
		1.72	0.044	0.990	0.976	0.12	
28	Monitoring and regulating emissions						0.76
29	Ensuring zero flaring to the atmosphere						0.70
34	Training for GSCM						0.69
32	Outlining detailed procedures for re-use and recycling						0.71
36	Investing in wind energy						0.64
11	Avoiding non-bio-degradable materials						0.72
30	Using motion-sensitive lights						0.65
	Monitoring utilities	χ^2/dof	RMSEA	CFI	NFI	$\alpha - Avg\ Corr$	Loadings
		1.53	0.003	0.975	0.990	0.01	
46	Improving digital communication						0.75
45	Using AI and IOT						0.73
44	Reducing CO_2 footprint						0.66

order latent factor, i.e., the overall trait of "greenness" implementation, governs the correlations among the six identified factors. The second-order model also produces acceptable goodness of fit. An examination of the second-order model of the greenness construct reveals that all of the coefficient estimates ("managing operations," "reducing resource requirements," "building eco-friendly infrastructures," "green computing," "avoiding risks and uncertainties," and "monitoring utilities") that describe the relationships or paths of the six factors on the higher-order construct of greenness implementation are significant. Thus, as indicated in Table 5, all the hypotheses in the section are true. It can be seen that the highest and the lowest impact of greenness appear to be on "reducing resource requirements" and "monitoring utilities," respectively.

5.5. Nomological validity test

Nomological validity verifies if the latent variables explain relationships as per the theoretical framework. Instrument can be

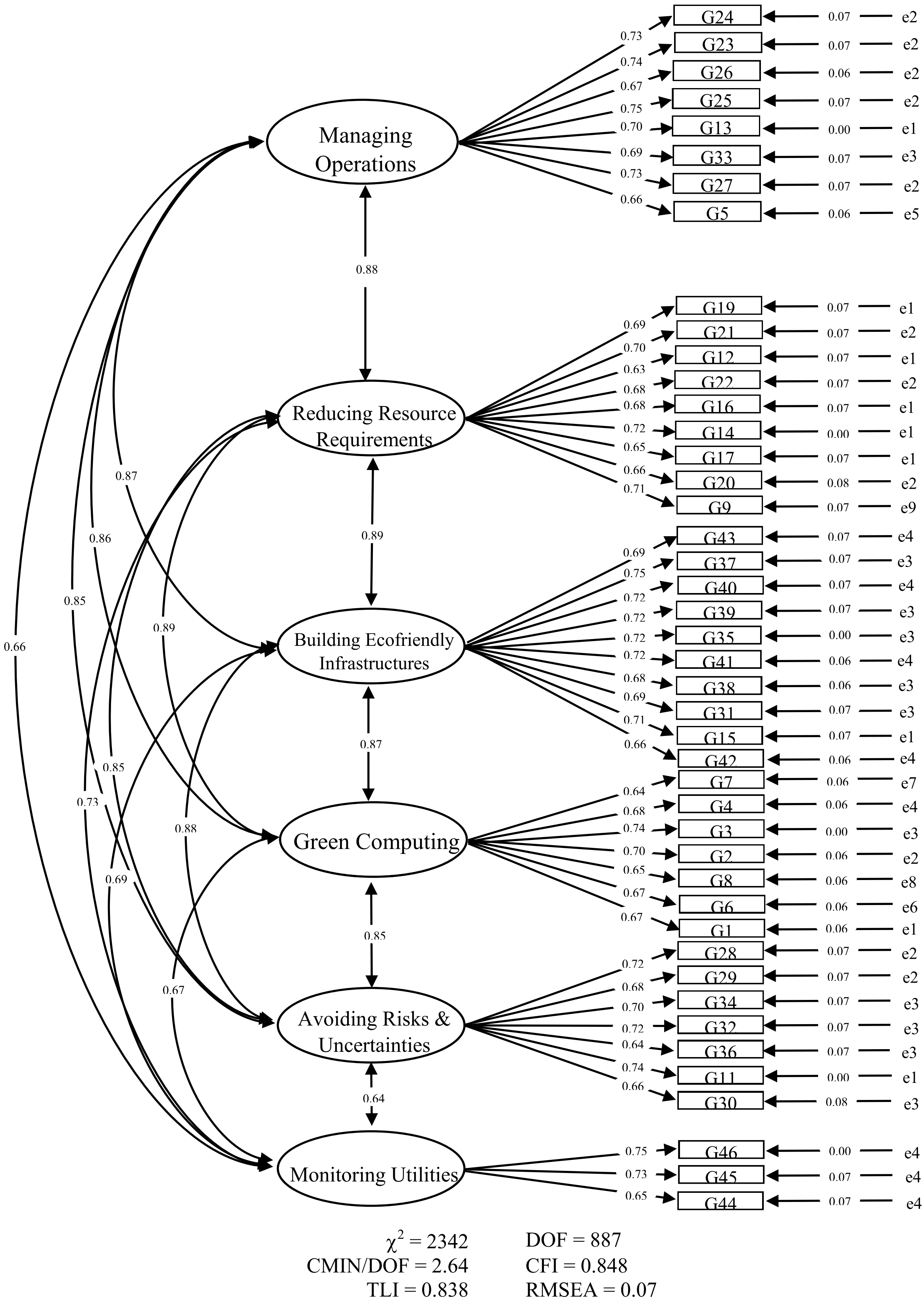

Fig. 5. – First-order measurement model for indicators of greenness.

considered nomologically valid when all factors positively correlate with one another ($p < 0.01$) (Straub et al., 2004). In this study, the nomological validity of the proposed greenness measure was tested for its consistency with theories and literature (Nunnaly, 1978). The greenness was placed as a dependent factor in the nomological network as shown in Fig. 6. The hypothesized model has an acceptable fit ($\chi^2 = 2349$, $dof = 896$, CFI = 0.848, TLI = 0.839 and RMSEA = 0.07). As shown in Fig. 6 and Table 5, greenness is positively and significantly

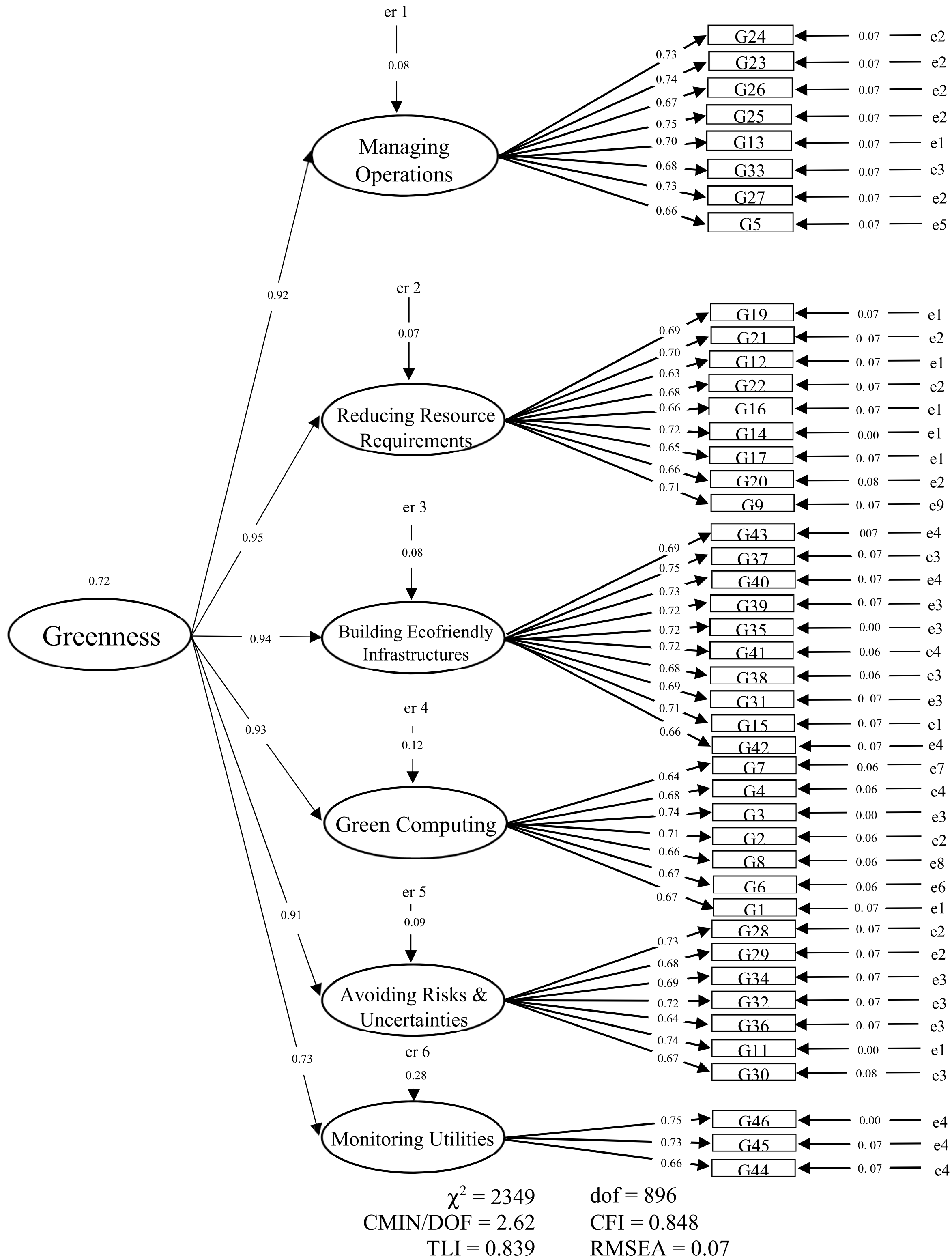

Fig. 6. Second-order measurement model for indicators of greenness.

impacted by *managing operations* ($\beta = 0.92$, $p < 0.01$); *reducing resource requirements* ($\beta = 0.95$, $p < 0.01$); *building ecofriendly infrastructures* ($\beta = 0.94$, $p < 0.01$); *green computing* ($\beta = 0.93$, $p < 0.01$); *avoiding risks & uncertainties* ($\beta = 0.91$, $p < 0.01$); *avoiding risks & uncertainties* ($\beta = 0.73$, $p < 0.01$). The suggested model has a satisfactory predictive capability as it explains a significant fraction of variance in greenness, i.e. $R^2 = 0.72$.

6. Discussion and implications

Advancement in technology has had far-reaching ramifications for businesses. Consequently, it has become crucial for firms to produce cheaper products in an efficient, flexible, and reliable manner. The use of appropriate strategies can help businesses achieve this goal. The implementation of greenness can help firms to bolster their

Table 5
Hypothesis testing.

Hypotheses	Path	Coefficient	p-value	Decision
H1	Managing Operations → Greenness	0.92	0.000	Accepted
H2	Reducing Resource Reqmt. → Greenness	0.95	0.000	Accepted
H3	Eco-friendly Infrastructures → Greenness	0.94	0.000	Accepted
H4	Green Computing → Greenness	0.93	0.000	Accepted
H5	Avoiding Risks/Uncertainties → Greenness	0.91	0.000	Accepted
H6	Monitoring Utilities → Greenness	0.73	0.000	Accepted

competitiveness by cutting down on unnecessary waste. Notably, the adoption of GSCM by organizations is intended to put pressure on their suppliers to conform to the relevant environmental standards. Suppliers are bound to ensure that their operations do not lead to the pollution of the environment. Some of the prominent advantages of greenness are cost minimization, enhanced efficiency, and profitability.

This paper aims to explore the extent to which organizational practices triggered by indicators lead to a higher level of greenness implementation in service supply chains in the UAE. While business organizations integrate different aspects of sustainability, they appear to struggle while attempting to implement greenness. As this is the result of a conflict of interest of different stakeholders, the lack of an empirical research framework for greenness makes it difficult both for managers and researchers to understand the theoretical and practical issues of greenness, which, in turn, creates a gap in the academic and practical areas.

Therefore, to fill this gap, the present research aims to broaden the knowledge of greenness by providing empirical evidence on how UAE-based service facilities implement greenness initiatives. More specifically, the purpose of this paper is to address the factors that drive a service supply chain's decision to focus on integrating greenness and exploring the extent to which those drivers lead to tangible performance outcomes concerning sustainability in the context of service. To this end, this paper is the first to combine stakeholder theory and resource-based view in the literature on greenness. The findings are mostly consistent with these theoretical views, and the paper offers a theoretical contribution to the area of greenness in the broader context of a supply chain.

First, this paper highlights the stakeholder perspective on the adoption of greenness. Stakeholder theory has been popularized as a helpful lens to view stakeholder influence on specific corporate objectives and decisions (Poddi and Vergalli, 2009). Second, the results of this paper provide synthesizing perspectives on RBV for the utilization of resources throughout a business. The proper allocation of resources can provide insights into the impact of integrating greenness into service facilities and drive changes to support sustainability practices (Marshall et al., 2015).

Using 371 responses from service units in the UAE, the key research objectives to which this research is aimed are: (1) to explore the antecedents of greenness in the UAE's service facilities; (2) to propose a comprehensive framework of greenness in service supply chains; and, (3) to investigate and validate the relationship among these dominant factors by introducing first- and second-order CFA models. The criterion-related validity of the measures in the framework was investigated with convergent and discriminant validity.

Moreover, exploratory factor analysis and first- and second-order confirmatory factor analysis were employed. The results indicated a six-factor model of greenness measures with a total of 46 items. These two techniques resulted in a framework of six indicators: "managing operations," "reducing resource requirements," "building eco-friendly infrastructures," "green computing," "avoiding risks and uncertainties," and "monitoring utilities."

With the drivers of greenness for a service organization, the relationships between the six factors are demonstrated in the exploratory model for greenness. The model predicts 58.80 % of the variance of greenness. This explanatory power is caused by different aspects of green practices, the desire for reputation, and quality awards. The six indicators have been found to have a significant impact on greenness in service activities in the UAE.

Within the context of the UAE, people are more knowledgeable about green issues and the environment, guided by the principles and outcomes laid out in the country's *Vision 2030*, which encompasses the three pillars of sustainability and aims to position the UAE among the best nations in the world in this respect.

The present research confirms that multiple factors and their measurement items should be comprehensively incorporated to obtain an overall view of greenness implementation in organizations. There is a need for organizations to promote greenness drivers from a holistic perspective. By focusing on each driver in isolation from others, organizations are disregarding the benefits that might be obtained if actions were taken to motivate stakeholders in all five areas combined. Our findings reveal that organizations must follow a comprehensive and coherent approach to develop more supportive perceptions regarding greenness in service.

This multi-dimensional view provides many benefits to service supply chains in the UAE by increasing the competitive advantage of the supply chain in comparison to other regions in the world. Moreover, it helps the government coordinate all service stakeholders' efforts by increasing communication and information sharing efficiently, which will eventually lead to high-quality service and, therefore, foster a culture of "prevention is better than cure."

7. Limitations and future research directions

This paper, like any research, has some limitations, which highlight areas for future research. Though the empirical results are in line with those in Al Aomar and Weriakat (2012) and Malik et al. (2016), who explored the notion of greenness and environmental concerns in the UAE, more research is needed to validate the theoretical model. One might also examine the framework in the manufacturing sector in the UAE. Testing the model in the service industries in other countries is also a promising future research direction.

The developed model can also be applied by regional and municipal authorities and commercial organizations conducting the tender process for the selection of contractors and suppliers of equipment for the construction of efficient homes. Also, an ecological and economic model may be designed for managers for the long-term management of residential buildings and the reduction of operating costs for the period of operation, hence reducing end-users' overall service costs and payments for utilities.

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Appendix

INDICATORS OF GREENNESS IN SERVICE ORGANIZATIONS

Greenness is a marketing term that refers to goods and services, laws, guidelines and policies that claim reduced, minimal, or no harm upon ecosystems or the environment

A.	**GENERAL INFORMATION**					
1	You are serving in this organization as a part of	Middle Management			Top Management	
2	Total number of employees in your organization	x < 500	500 < x < 1000			x > 1000
3	Total revenue of the organization in million AED	x < 10	10 < x < 50			x > 50
4	Ownership of your organization is	Local	Foreign Body			Mixed
Please select "one" response to each of the following questions:						
B.	**INDICATORS OF GREENNESS**	*Strongly Disagree*	*Disagree*	*Neutral*	*Agree*	*Strongly Agree*
1	Reducing use of paper					
2	Using solar energy					
3	Reducing use of water					
4	Reducing electricity consumption					
5	Rating products on energy consumption					
6	Implementing green assessment of suppliers					
7	Reducing transportation (internal/external)					
8	Procuring environmentally friendly products					
9	Ensuring minimum environmental impact					
10	Pushing to offset financial and environmental risk					
11	Avoiding non-bio-degradable materials					
12	Keeping electronic records					
13	Reporting opportunities for reducing resource requirements					
14	Using refurbished components					
15	Deploying a green monitoring team					
16	Offering online services					
17	Optimizing operations					
18	Implementing waste management					
19	Reducing defects					
20	Using e-signatures					
21	Enforcing employee self-service					
22	Pushing for lower utility costs					
23	Ensuring green-wash for vehicles					
24	Reducing wastage					
25	Reducing use of plastic					
26	Reducing dependence on synthetics					
27	Using energy efficient air-conditioning					
28	Monitoring and regulating emissions					
29	Ensuring zero flaring to the atmosphere					
30	Using motion-sensitive lights					
31	Filling trucks with multiple orders/consignments					
32	Outlining detailed procedures for re-use and recycling					
33	Using smart grids					
34	Training for GSCM					
35	Allocating budget for green initiatives					
36	Investing in wind energy					
37	Diversifying product functionality					
38	Following Abu Dhabi 2030 Vision					
39	Balancing short-term and long-term objectives					
40	Investing in research and development					
41	Ensuring recycle bins around premises					
42	Designing eco-friendly buildings					
43	Implementing regular eco-compliance audit					
44	Reducing CO2 footprint					
45	Using AI and IOT					
46	Improving digital communication					

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