Green supply chain management (GSCM) practices and their impact on performance: An insight from the Jordanian construction sector

Noor Al-Ma'aitah, Mutah University, Jordan
nmaaitah@mutah.edu.jo

ABSTRACT

This paper aims to investigate the relationship between green supply chain management (GSCM) practices and performance (environmental, economic and organisational) within the construction sector in Jordan. Based on the literature review, the survey designed included 46 key items. Data was collected from 133 managers in the construction sector. Multiple regression analysis was undertaken to test the study hypotheses. The analysis showed mixed results, green construction and investment recovery was supported in three hypotheses; internal environmental management was supported only with organisational performance. The practical implications of the findings include creating more effort to attaining benefits from the world trade organisation (WTO) initiatives to establish long-term relationships with foreign customers to learn and enhance green practices in Jordan's construction sector. This work is one of few studies that investigates GSCM practices in the construction sector of a developing country.

KEYWORDS: Construction, Green Supply Chain Management, Jordan, Performance.

INTRODUCTION

Climate change and environmental pollution are the greatest challenges for organisations in the 21st century (Amemba *et al.*, 2013; Balasubramanian &Shukla, 2017a, b). One of the main sector that is facing a huge challenge is the construction sector due to its large contribution on the environment (Balasubramanian & Shukla, 2017a,b). It is responsible for one-third of global carbon emissions, one-third of global resource consumption, 40 per cent of the world's energy consumption, 40 per cent of global waste generated and 25 per cent of the world's total water consumption (Balasubramanian & Shukla, 2017a,b) .With 66 per cent of the world's population expected to live in urban areas by 2050, the CO2 emissions from this sector alone are projected to reach 15.6 billion metric tons by 2030, almost double the 2004 estimates (Balasubramanian & Shukla, 2017a,b). Left unchecked, our planet cannot handle this level of growth and its associated impacts. Therefore, immediate actions for greening the construction sector are essential for ensuring the survival of future generations (Balasubramanian & Shukla, 2017a,b). Many empirical studies have been conducted in various sectors such as manufacturing, electrical and electronic, automobile and other sectors on the relationship between GSCM practices and company performance (Petljak *et al.*, 2018).

With increased competition, regulatory and community pressures for environmental sustainability, companies have resorted to applying strategies that balance their economic and environmental performance (Zhu *et al.*, 2012). Zhu *et al.* (2007) expressed the need for a more

detailed study analysing the relationship between green supply chain management (GSCM) practices and individual factors of performance to help managers identify GSCM practices that best enforce activities, and that need more improvement. Supply chain managers start addressing more complex issues rather than basic criteria such as cost, quality, and delivery (Vachon & Klassen, 2006), and implementing different approaches such as cleaner production, and environmental management system for green management practices. GSCM has emerged as an approach to improving performance and achieving process and products, according to the requirements of environmental regulations (Amemba *et al.*, 2013). Globalisation plays a significant role in increasing the pressure on enterprises to improve their environmental performances (Chien & Shih, 2007). Since environmental impacts occur at all stages of a product's life cycle, GSCM has emerged as an important new strategy for enterprises to achieve profit and market share objectives by reducing their environmental risks and impacts, while raising their ecological efficiency (Amemba *et al*., 2013; Zhu *et al*., 2008; Zhu & Sarkis, 2006; Zhu *et al*., 2005).

Many studies show the relationship between GSCM practices and performance. GSCM practices can improve environmental performance (Diabat & Govindan, 2011; Green *et al*., 2012; Testa & Iraldo, 2010). Also economic performance has been studied but results are conflicting, with limited work examining the relationship between GSCM and operational performance (Shu *et al.*, 2012; Vachon & Klassen 2006; Walker *et al*., 2008; Zhu *et al.*, 2012).

GSCM is gaining increasing interest among researchers and practitioners of operations and supply chain management (Amemba *et al*., 2013). The growing importance of GSCM is driven mainly by the environmental and economic benefits of implementing green practices such as being environment friendly, reducing waste of material, and decrease the consumption of energy (Amemba *et al*., 2013). Although the issue of GSCM has received an increased attention in recent years, much of the empirical studies is dominated by western studies and in developed contexts mainly Europe and North America (Srivastava, 2007) and with a little bit in emergent economies (Zhu *et al*., 2008b). Yet, Studies of the relationships between green practices and organisational performance in developing countries have not been extensive (Zhu & Sarkis, 2007; Zhu & Sarkis, 2006). In developing countries, GSCM practices to reduce waste in the construction industry are not remarkable (Balasubramanian & Shukla, 2017; Chowdhury *et al*., 2016). The current research aims to investigate GSCM practices on multiple dimensions of performance including environmental, economic and business performance dimensions in the Jordanian construction sector. Consequently, this study addresses the following research question: *do GSCM practices relate to performance outcomes in the Jordanian construction setting*?

This study seeks to contribute to the green supply chain management literature. It presents an empirical data from a developing country, which is a rarely studied in literature, as well as makes a valuable contribution to construction literature. This study also provides an insight for decision makers and managers in Jordan, to increase their awareness for adopting GSCM strategy to improve their performance.

The study is structured as follows: a literature review that identifies the relationship between green supply chain management practices and performance dimensions in order to present the research hypotheses. The solution methodology of the study is then presented. After the methodology, an outline of the findings of the study is presented, which is then followed by a

discussion section. Finally, conclusions are drawn, including limitations of the research and future research directions.

GREEN SUPPLY CHAIN MAGEMENT (GSCM)

Green supply chain management (GSCM) has achieved more interest among researchers and practitioners of supply chain management in last decades (Srivastava, 2007; Diabat & Govindan, 2011; Petljak *et al.*, 2018; Zhu *et al.*, 2005; Zhu & Sarkis, 2006). The growing importance of GSCM is driven mainly by the desire to minimise the negative environmental impacts of firms' activities by eliminating wastages, saving resources, improving productivity, achieving profits and overall market share (Balasubramanian & Shukla, 2017; Chien & Shih, 2007; Dubey *et al*., 2014; Ninlawan *et al*., 2010; Srivastava, 2007).

There are many of definitions of GSCM in literature (Nasrollahi, 2018). Srivastava (2007, p 55) defined it as 'integrating environmental thinking into supply-chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life'. Ninlawan *et al*., (2010) and Chien and Shih (2007) defined the practices included in it as green procurement, green manufacturing, green distribution, and reverse logistics. Zhu *et al*., (2005), Zhu and Sarkis (2006) and Zhu *et al.*, (2008) defined it as "closing the loop" that range from green purchasing to customer and reverse logistics. In the same vein, Sarkis *et al.*, (2001) stated that GSCM integrates environmental thinking into inter-organisational practices of SCM including reverse logistics. For the purpose of the present research, GSCM is viewed as an operational cycle (purchasing, manufacturing, distribution etc.) with environmental concern in order to achieve environmental, economic, and operational performance for an organisation (Diabat & Govindan, 2011).

Green supply chain management include a number of practices that literature divided into: internal and external practices that relate to environmental issues and performance (Vachon & Klassen, 2006; Zhu *et al*., 2012). Internal activities are defined as practices that can be managed and implemented by individual manufacturers. External GSCM practices are activities that require some level of cooperation with external stakeholders such as suppliers and customers. Both internal and external GSCM practices may result in environmental, operational, and economic performance improvements (Zhu *et al.*, 2013). Zhu and Sarkis (2004) stated the need for further understanding of the relationship between GSCM and performance, especially for companies in countries that need to balance between growing economy and environmental protection. However, the aim of the present research is to discuss the relationship between GSCM practices adopted by the construction sector in Jordan and performance. The GCSM practices adopted for the present research modelis depicted in Figure 1.

Green Purchasing (GP)

Green purchasing is one of the main aspects of GSCM practices which have received much research attention in developed countries but still lagging behind in practice in developing countries (Petljak *et al.*, 2018; Zhu *et al*., 2008; Zhu & Sarkis, 2008;). It is important because every buying decision has a hidden cost on the environment (Shah & Muradizaman, 2013) and reflects a way to gain competitive advantage and improving the firm's performance (Walker *et al*., 2008).

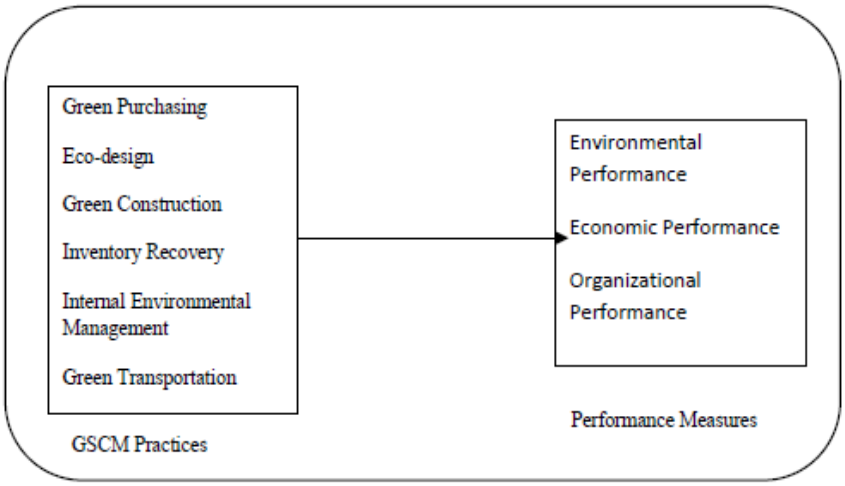

Figure 1: Research Model

Green purchasing is an environmental procurement that involves reduction, reuse, and recycling of materials (Chowdhury *et al*., 2016; Chien & Shih, 2007;Diab *et al*., 2015; Mukiri, 2007; Ninlawan *et al*., 2010; Sarkis, 2003). The selection of vendors who have ISO 1400 certificate is expected to eliminate environmental risk by providing design specification to suppliers that include environmental requirements for purchased items, cooperation with suppliers for environmental objectives, and environmental audits for supplier's internal management. The reduction in environmental risk improves profitability and then will have those vendors for long-term businesses (Sarkis, 2003; Zhu *et a*l., 2008). In the same vein, Chien and Shih (2007) in their empirical study for the implementation of GSCM practices on organisational performance, found that green purchasing influences both environmental and financial performance. Green *et al*., (2012) argue that green purchasing and supply policies are likely to result in improved environmental performance. Zhu *et al.*, (2012) stated that green purchasing mediates the relationship between eco-design and economic and operational performance. Amemba *et al.*, (2013) stated that green purchasing eliminates waste, reduces the use of resources as much as possible and then can improve firm's economic position. In addition, some scholars stated that purchase decision- making that includes friendly features products, such as recycled material and non-toxic ingredients (Balasubramanian & Shukla, 2017; Petljak *et al*., 2018) improve organisational performance by decreasing wastages in materials, protecting resources and enhance the company's reputation and public image (Zhu & Geng, 2002).

Eco-Design (ECO) / Green Design

Eco-design is the process concerned with the development of a new product. It includes environmental health safety, product safety, resource conservation, pollution prevention, environmental risk management, and waste management (Amemba *et al*., 2013; Chowdhury *et al*., 2016; Srivastava, 2007). Green design (Eco-design) has been used extensively in literature to denote designing products with certain environmental considerations (Amemba *et al*., 2013). In their study for the drivers to implement GSCM, Diabat and Govindan (2011) found that integrating green design into the planning and operation process, reduces energy consumption. Diab *et al*., (2015) and Sarkis (2003) stated that eco-design requires manufacturers to design their product to minimize the consumption of materials and energy, facilitate the reuse, recycle, and recovery of components and materials, and to avoid or reduce the use of hazardous

materials in manufacturing by replacing the hazardous materials with less problematic materials (Amemba *et al.*, 2013).

Green design is an emerging practice in China for example, which influences both internal and external GSCM practices implementation (Zhu *et al*., 2008). Eco-design has the potential to improve operational performance only if green purchasing is in place (Zhu *et al.*, 2012).As a result, products consuming less materials and energy can be more profitable and ensure more market share (Zhu *et al.*, 2012; Zhu & Sarkis, 2006). Manufacturers could achieve world-class economic performance by producing environmentally acceptable products, in turn; improve environmental performance (Mukiri, 2007). In the construction sector, green design stage impacts the buildings when designers consider climate conditions, building structure and shape and its thermal characteristics in order to cut down power consumption. In addition, considering new technologies such as solar panels, energy efficient heating, lighting and wastewater recycling technologies, are essential for improving the environmental performance of buildings (Balasubramanian & Shukla, 2017).

Green Construction (GCON)

Grean construction is "a kind of production process that uses input with reasonably less environmental impacts, is highly effective, and produces little or no pollution or waste" (Chowdhury *et al*., 2016, p4). Green manufacturing includes the capability of the organisation to use certain materials, integrate reusable or remanufactured component into the designed process to prevent waste (Amemba *et al*., 2013; Srivastava, 2007; Sarkis, 2003). Diabat and Govindan (2011) found that reusing, recycling, and packaging are top drivers to implementing GSCM. Green manufacturing can lead to lower raw material costs, production efficiency gains, reduced environmental and occupational safety expenses, and improved corporate image (Ninlawan *et al.*, 2010). Mukiri (2007) stated that the process of reducing the harmful environmental impact activities happen without sacrificing quality, cost, energy utilization efficiency or performance by using a cleaner technology in the production process that reduces the waste and pollution. In their study for the implementation of GSCM practices on organisational performance in the electrical and electronic industry in Taiwan, Chien and Shih (2007) found that green manufacturing practices influence both environmental and financial performance. The adoption of green manufacturing practice helps in saving cost, companies could adopt wind and solar energy, which reduces the energy cost and governments offering tax reduction for green investments, in turn, generates more profits (Shah & Muradizaman, 2013). In addition, green manufacturing is linked to just-in-time, ISO 9000, ISO 14000, and six sigma practices. These practices work on cost reduction, improving quality, eliminate defects and cutting waste. In turn, significant saving is made (Shah & Muradizaman, 2013).

In the case of construction, green construction/manufacturing refers to the use of onsite practices to minimize the environmental Impacts of construction. These practices are relevant only to main/sub-contractors and involve considerations such as waste management planning, the use of automation, the implementation of wastewater recycling technology, the adoption of offsite-prefabrication, the use of fuel-efficient machinery and the use of energy efficient and low hazardous materials (Balasubramanian & Shukla, 2017).

Investment Recovery (IR)

Investment recovery is a general practice that can diminish waste by reclaiming value from a product at the end its life's cycle (Amemba *et al*., 2013; Chowdhury *et al.*, 2016). IR is a

practice in business, which involves the resale of surplus inventory or material, extra capital equipment, as well as used or scrap materials (Kaliani *et al.*, 2018).This practice has less attention in developing countries than developed countries due to the inappropriate recycling system of waste management policies (Chowdhury *et al.*, 2016; Zhu *et al.*, 2007; Zhu & Sarkis, 2006; Zhu *et al.*, 2005; Zhu & Sarkis, 2004). Investment recovery is a traditional business practice, but it can also be considered a green practice since it can reduce waste that may have otherwise been disposed. Even though investment recovery may not be the most sustainable practice, it does lengthen the life of products or materials where they can be recycled into other products or materials (Zhu & Sarkis, 2004). IR has a role in planning the purchasing and handling materials, in turn, minimize the cost and reduce waste generation. It has a link with lean manufacturing to help to more effectively environment by controlling the inventory. The remaining materials should be stored in the inventory. Efficient inventory planning and management does not only help to decrease solid wastes, but also improve environmental performance (Al-Kkattab *et al.*, 2015). In the same vein, Green *et al.*, (2012) stated that IR leads to environmental performance but not economic performance. Zhu and Sarkis (2007) found that large and medium size enterprises have higher implementation of inventory recovery than small size companies and influence both environmental and economic performance. Kaliani *et al.* (2018) propose that IR is the practice of dealing with surplus assets that can cut down the total waste. In addition, decrease the inventory by recycling scrap, in turn, influence the environmental and economic performance.

Internal Environmental Management (IEM)

Internal environmental management (IEM) is a practice that includes senior management commitment, mid-level management support, cross-functional assistance, total quality management, environmental auditing program, and ISO 14001 certification (Chowdhury *et al.*, 2016; Diab *et al.*, 2015). IEM has been the most widely adopted set of GSCM practices by Chinese manufacturers (e.g. Zhu *et al.*, 2013; Zhu *et al.*, 2012; Zhu *et al.*, 2008; Zhu *et al.*, 2007; Zhu *et al.*, 2005; Zhu & Sarkis, 2004). There is consensus within literature that internal environmental management is a key to improving enterprises' performance. Without this initial upper management commitment, most programmes are bound to fail, much less be truly initiated (Zhu & Sarkis, 2006).It is well known that senior managers' support is necessary and, often, a key driver for successful adoption and implementation of most innovations, technology, programmes and activities. To ensure complete environmental excellence, top management must be totally committed. Communication between business managers and environmental professionals is also important in the successful business and environment relationship (Green *et al.*, 2012; Zhu *et al.*, 2005; Zhu & Sarkis, 2006).

Green Transportation (GTran)

The Green transportation practice includes modes of transportation, control system, and just-in-time policies. The distribution is the most tied to the customer's requirements. Thus, customer involvement in designing the distribution system will provide effective and efficient distribution network and improve just in time system (Sarkis, 2003). Logistics activities are transportation and warehousing. Green logistics cover all activities related to the selection of the best transportation means, load carriers and transportation routes to reduce the environmental impact of the whole supply chain. The food retail sector is logistics intensive, which justifies green logistics as a supply chain process-related construct. Because transportation tends to have the highest environmental impact in the logistics system, retailers

are taking the initiative to make their supply chains more environment friendly, for example, by reducing transportation distances and optimizing warehouse locations (Petljak *et al*., 2018). Green distribution are consists of green packaging and green logistics. Packaging characteristics such as size, shape, and materials have an impact on distribution because of their effect on the transport characteristics of the product. Better packaging, along with rearranged loading patterns, can reduce materials usage, increase space utilization in the warehouse and in the trailer, and reduce the amount of handling required (Ninlawan *et al.*, 2010). Consistent with previous studies, Balasubramanian and Shukla (2017) stated that green transportation is the practice aims to minimize the environmental impacts associated with transportation. Construction projects typically have a significant amount of transportation activities, which involve both employee transport and material transport. 6-8% of carbon emitted during a construction project is due to the transportation of materials, and therefore transportation strategies, such as full-truck quantities and fuel-efficient vehicles to minimize emissions, should not be overlooked. Similarly, the use of video conferencing instead of face-to-face meetings, shared and public transport instead of personal transport and employee accommodations near project sites can reduce employee-related transportation impacts.

PERFORMANCE MEASUREMENTS

Along with the rapid change in business markets and the increased environmental and social issues that affect the way that organisations manage their businesses, GSCM practices is also an approach to improving performance (Petljak *et al.*, 2018). Performance measures are the way to evaluate the success of firm's objectives and deciding their future plans (Balasubramanian & Shukla, 2017). In the case of GSCM, environmental performance is the primary target objective (Zhu & Sarkis, 2004), given that green practices are an extra investment for companies, then, there is a need to achieve balance between environmental achievements, short-term financial performance (e.g. reduction in material or energy costs) and long-term financial performance (e.g. profitability and market share) to meet the expectations of a wide range of shareholders ((Balasubramanian & Shukla, 2017; Darnell *et al.*, 2008; Green *et al.*, 2012; Sarkis, 2003). Measuring green performance by separating environmental and economic performance construct has become somewhat standard in related research (Petljak *et al*., 2018; Zhu & Sarkis, 2004; Zhu *et al*., 2007). Using existing literature, a set of measures for the construction sector was developed, which are briefly described in the next sub-headings.

Environmental Performance

Environmental Performance "concentrates on reduction of air emission, reduction of waste water, reduction of solid wastes, in addition to decrease of consumption for hazardous/harmful/toxic materials, decrease of frequency for environmental accidents, and improve an enterprise's environmental situation" (Diab *et al*., 2015, p 151).While this relationship has not been investigated widely in construction sector, it does in other sectors with varying extent. Literature supports the positive relationship between green practices and environmental performance. For example, Chien and Shih (2007) divided environmental performance into operative performance indicator (OPI) and management performance indicator (MPI). OPI concentrates on material's consumption, waste production, and energy management. MPI focuses on administration's efforts and measures of overall organisation's environmental management. Effective management of suppliers should reduce transaction costs and increase recycling of materials, in turn; the production of waste can be cut.

Consequently, the use of energy and water become more efficient. Shal and Muraduzaman (2013) stated that companies that adopted GSCM practices supported by JIT practices, ISO 9000 and 14000, and six sigma improve their environmental performance by eliminating defects from manufacturing process, hence, cutting waste. Zhu *et al.* (2008) in their confirmation model of GSCM practices state the positive relationship between IEM, GP, CC (cooperation with customer), ECO-design, IR and environmental performance. In their study of internal and external green practices (GP, CC, RL, and IR) on performance, Zhu *et al.* (2012) and Zhu *et al.* (2005) stated that external practices and internal practices promote environmental performance.

Marhamati and Azizi (2017) found that internal green practices (green policy, green shipping, and green marketing) influence external practices (collaboration with suppliers, collaboration with partners, and collaboration with customers) and both affect green performance (reduction in pollutants and green costs), in turn, enhance the firm's competitiveness. Zhu *et al.* (2013) found that IEM and CC influence environmental performance positively. Zhu and Sarkis (2004) results show a significant relationship between green practices (IEM, external GSCM, eco-design, and IR) with environmental performance. In the same vein, Zhu and Sarkis (2007) found that GP and Eco-design have a positive impact on environmental performance. Diab et al., (2015) found that GSCM practices (IEM, CC, GP, warehousing) in the Jordanian food sector has an impact on environmental practices. Petljak *et al.* (2018) studied GSCM practices (green logistics, green purchasing, and cooperation with suppliers) in the food sector in Croatia and found that all three practices are positively related to environmental performance. In their study of the impact of GSCM on performance, Green *et al.* (2012) found that CC, Eco-design, and IR are related positively with environmental performance but not green purchasing. Zhu *et al.*, (2007) GSCM implementation has only slightly improved environmental and operational performance. Dubey *et al.* (2014) found that technology best practice and the manufacturing process and waste reduction through collaboration with suppliers are positively related to environmental performance. In the construction sector, Balasubramanian and Shukla (2017) found a strong positive relationship between core green practices green purchasing, green transportation, and green manufacturing/construction (GP, GT, GM respectively) and environmental performance. This lead to the following hypothesis:

H1: GSCM practices positively impact environmental performance in construction sector in Jordan.

Economic Performance

As was previously highlighted, firms that implement GSCM practices not only achieve environmental objectives but also economic performance. Positive economic performance related to cutting the cost for materials purchasing, reduction in water expenses, decrease in energy consumption, decrease of fee for waste treatment, reduction in environmental penalties and fines and at the same time trying to eliminate negative economic performance. These negative economic performance include: increase of investment, increase of operational cost, increase of training cost, increase cost of purchasing environmentally friendly materials (Balasubramanian & Shukla, 2017; Diab *et al*., 2015; Green *et al*., 2012; Hervani *et al*., 2005; Petljak *et al*., 2018; Zhu & Sarkis, 2004).

Whether GSCM practices cause or relate to positive or negative economic performance is still mixed (Zhu *et al.*, 2012). On one hand, Ninlawan *et al*., (2010), Zhu *et al*., (2008a), and Zhu

and Sarkis (2004) stated that GSCM practices impact economic performance positively. In addition, Green *et al.* (2012) indicated that GSCM practices focus on the elimination of wastes associated with environmental sustainability. Such waste minimization should lead to reduced costs resulting in improved economic performance. Zhu and Sarkis (2007) found that competitive pressure significantly improves economic benefits from adoption of a number of GSCM practices. In construction sector, Balasubramanian and Shukla, (2017) indicate the positive results of GSCM practices and economic performance. On another hand, Zhu *et al.*, (2013) stated that GSCM practices do not directly affect economic performance, but can improve it indirectly. Zhu *et al.* (2005) stated that GSCM practices has improved performance of Chinese enterprises in terms of their environmental and operational performance but not economic performance. Thus, the general proposition is not supported for economic performance factors. These results are consistent with Petljak *et al.* (2018) that none of GSCM practices affect economic performance in the food sector in Croatia, same results as Zhu *et al.* (2007). However, in the current research investigation, the study argues that:

H2: GSCM practices positively impact economic performance in construction sector in Jordan.

Organisational Performance

To complete the study's research model, organisational performance is included. Organisational performance refers to the financial and marketing performance of an organisation as compared to its industry (Green *et al.*, 2012).

Literature indicated the positive impact of environmental activities on financial performance. GSCM practices reduced the cost of materials purchasing and energy consumption, cut the cost of waste treatment and discharge, and avoid a fine in the case of environmental accidents (Green *et al*., 2012; Zhu & Sarkis, 2004). For example, Chien and Shih (2007) stated that the implementation of GSCM practices has a positive relationship with financial performance. Financial performance is defined as cost reduction, market share growth and profit increase. Dubey *et al.* (2014) found that supplier relationship management and waste reduction are positively related to business performance (reduction in energy cost, increase in sales revenues, and increase in profitability). In the construction sector, Balasubramanian and Shukla (2017) stated the positive benefits between GSCM practices and organisational performance. A firm's investment in green activities not only promotes environmental or cost performance but also enhance the brand image of the company resulting in improved organisational performance. The relevant measures for construction borrowed from other sectors include; increases in sales revenue; increases in selling price; increases in market share; increases in return on investment; and increases in profits. (Balasubramanian & Shukla, 2017). However, the present research proposes the following:

H3: GSCM practices positively impact organisational performance in construction sector in Jordan.

Having developed the GSCM framework (Figure 1), the next stage is to test and validate the constructs in the framework and examine the proposed hypotheses. A survey-based research methodology was employed to achieve this objective. The research methodology is explained in the following section.

RESEARCH METHODOLOGY

Population and Sample

This study follows previous studies (Marhamati & Azizi, 2017; Zhu *et al*., 2012; Zhu & Sarkis, 2004)targeting middle level or high level managers who could reliably be expected to provide more accurate perceptions of GSCM practices and performance within their respective organisations. These are also members of Jordanian Construction Contractors Association (JCCA). The sample was described by three questions; classification and level of the organisation in the Jordanian Construction Contractors Association (JCCA), and the position of the respondent. As shown in Table 1, more than 53% of the responses came from building specialised companies, and the majority of the sample got a third level company rating (i.e. 3 stars) with 36.1%. Furthermore, above 93% of the respondents were general managers or project managers.

Table 1: Descriptive Analysis: Samples' Characteristics

CHARACTERISTICS		FREQUENCY	PERCENT (%)
Classification	Buildings	71	53.4
	Roads	21	15.8
	Water and Waste Water	21	15.8
	Electromechanical	20	15.0
Level	First	42	31.6
	Second	16	12.0
	Third	48	36.1
	Fourth	7	5.3
	Fifth	20	15.0
Position	General Manager	68	51.1
	Purchasing Manager	9	6.8
	Project Manager	56	42.1

Data Collection

Data was collected via a self-administered survey (see Appendix) and was developed in English, then translated into Arabic. A pilot survey test was conducted to gain insight to the perceptions of middle or higher level managers on GSCM practices. The results from the pilot study indicated that no modifications was required.

The data was collected through a drop-off and pick-up approach which was considered the most efficient method to improve the response rate (Al-Ma'aitah, 2018; Al-Ma'aitah, 2014). A cover letter was included to explain the purpose of the study. Due to the difficulties in obtaining data, a convenience sample is used following Holt and Ghobadian, 2009; Zhu and Sarkis, 2006; Zhu and Sarkis, 2004. 133 questionnaires were distributed and received, corresponding to a response rate of 100%.

Table 2: Measures Development

Measurement	No. of Items	Source	Cronbach's Alpha
IEM	7	Zhu *et al.*, 2008a	0.94
GP	5	Zhu *et al*., 2008a	0.87
Eco-design	3	Zhu *et al.*, 2008a	0.86
GT	5	Balasubramanian & Shukla, 2017	Above 0.70
GC/GM	7	Balasubramanian & Shukla, 2017	Above 0.70
IR	3	Zhu *et al*., 2008a	0.83
Environmental performance	7	Balasubramanian & Shukla, 2017	Above 0.70
Economic Performance	5	Balasubramanian & Shukla, 2017	Above 0.70
Organisational Performance	5	Balasubramanian & Shukla, 2017	Above 0.70

Measures Development

To design the survey for this study, previous seminal works on GSCM practices and performance were reviewed (e.g. Balasubramanian & Shukla, 2017; Green *et al*., 2012; Petljak *et al.*, 2018; Zhu *et al.*, 2013; Zhu *et al.*, 2012;Zhu *et al*., 2008a; Zhu *et al.*, 2007; Zhu *et al*., 2008b;Zhu *et al.*, 2005). Table 2 provides information on the measures, with 29 items related to GSCM practices using a five-point scale (with 1= Not considering it, 2= Planning to consider it, 3= Consider it currently, 4 = Initiating implementation, and 5 = Implementing successfully). Further there were 17 items included to measure performance (environmental, economic and organisational) using a five- point scale (with 1= Not at all, 2= Some but insignificant; 3= Some and slightly significant; 4= Significant; and 5= Highly significant).

Table 3: Reliability and Validity

Factor	No. of Items	Mean	Sd	CronbachAlpha	Range of Item-To-Total Correlation
IEM	7	3.37	1.24	0.953	0.807-0.905
GP	5	3.78	0.72	0.748	0.322-0.636
GTran	6	3.26	1.07	0.847	0.565-0.714
Eco-design	3	3.71	0.72	0.804	0.635-0.686
Gconstruction	6	3.32	1.15	0.907	0.649-0.828
IR	3	2.73	1.47	0.936	0.829-0.907
EnvPer	7	3.11	0.80	0.898	0.644-0.787
EcoPer	5	3.00	0.82	0.880	0.606-0.872
OrgPer	5	3.67	0.97	0.888	0.408-0.852

DATA ANALYSISAND RESULTS

Reliability and Validity

To determine the reliability and unidimensionality of the variables, a reliability test and item–total correlation analyses was performed (see Table 2). The results indicate that all the factors met the accepted Cronbach's alpha ($\alpha \geq 0.60$) as shown in Table3. Item–total correlation refers

to a correlation of an item or indicator with the composite score of all the items forming the same set. "Items from a given scale exhibiting item–total correlations less than 0.50 are considered part of the domain of a single construct" (Zhu *et al.*, 2008, p 327).

Hypotheses Testing

Multiple regression was used to test the relationship between all constructs in the hypothesised model using SPSS 19. The data was tested for linearity and multi-co-linearity. The results indicate that VIFs are all less than the commonly used threshold of 10 in the literature (Field, 2005; Wiengarten *et al.*, 2011), indicating that multi-co-linearity is not a problem; therefore, the underlying assumptions of multiple regression analysis were not violated.

The results of the GSCM practices and environmental performance model in Table 4, indicate that the model is significant (F=39.492, sig=0.000<0.05) and R^2 = 0.653. These results indicate a partial support for hypothesis H1. The results show that green construction and investment recovery are the only accepted green supply chain practices with a significant value 0.000 and 0.04, respectively (p value <0.05).

Table 4: Test Results

GSCM	ENV PER		ECO PER		ORG PER	
	t-value	P-value	t-value	P-value	t-value	P-value
IEM	1.757	0.081	-1.430	0.155	9.07	0.000
GP	-0.827	0.410	-0.367	0.714	1.176	0.242
GTran	-0.257	0.798	-0.961	0.338	1.925	0.056
GConst	3.697	0.000	4.524	0.000	5.360	0.000
IR	2.060	0.041	2.702	0.008	5.013	0.000
Eco-design	0.191	0.849	-0.850	0.397	0.608	0.544
	R^2= 0.653		R^2= 0.593		R^2= 0.923	

Hypothesis H2 focused on the relationship between GSCM practices and economic performance in the construction sector. The results of the model in Table 4, show that R^2=0.593, adjusted R^2=0.574. The multiple regression analysis shows support for two green practices which are green construction (t=4.524, p=0.000) and investment recovery (t=2.702, p=0.008). However, the results show a partial support for H2.

The results of the multiple regression analysis for the relationship between GSCM practices and organisational performance (Table 4) model indicate that R^2=0.923, adjusted R^2=0.919. Also, the results show that internal environmental management (IEM) (t=9.072, p=0.000), green construction (GCONS) (t=5.360, p=0.000), and investment recovery (IR) (t=5.013, p=0.000) are supported the relationship with organisational performance but not green purchasing (GP) (p=0.242), eco-design (Eco) (p=0.544) and green transportation (GTrans) (p=0.056). However, H3 is partially supported.

DISCUSSION OF FINDINGS

While the relationship between green practices and environmental performance has not been investigated in the construction sector, there is an evidence in the literature on other sectors that green practices improve environmental performance (Balasubramanian & Shukla , 2017).

Recent studies are in clear support that GSCM practices positively contribute to environmental performance (Balasubramanian & Shukla , 2017; Chien & Shih 2007;Dubey *et al.*, 2014; Zhu *et al.*, 2005; Zhu *et al.*, 2008; Zhu *et al.*, 2012; Zhu *et al.*, 2013;Zhu & Sarkis, 2004). Green *et al.*, (2012) found that CC, Eco-design, and IR are related positively with environmental performance but not green purchasing.

The results of the current research indicate that only green construction (GCONS) and investment recovery (IR) have a positive relationship with environmental performance. It could be argued that the Jordanian construction sector is still in the early stages of adapting environmental management practices in their businesses, and theis a possibility that the size of the firm may influence the implementation of GSCM practices (Zhu *et al.*, 2007). In addition, these results could fit with the classification level of the respondents organisations since the higher level of respondents 36.1 percent came from third level class. Also, highlight the need for educated enterprises about GSCM practices and its impact on environmental performance (Zhu & Sarkis, 2006).

The literature indicates that whether GSCM practices cause or relate to positive or negative economic performance is still mixed (Zhu *et al.*, 2012). The results of our research consist with the literature and found that only green construction and investment recovery has a relationship with economic performance. Zhu *et al.*, (2013) stated that GSCM practices do not directly affect economic performance, but can improve it indirectly. Zhu *et al.*,(2005) indicated that the mean of positive economic performance is lower than the mean of negative economic performance (3.45). Thus, the general proposition is not supported for economic performance factors. These results also consist with Petljak *et al.*, (2018) that none of GSCM practices affect economic performance in food sector in Croatia, same results as Zhu *et al.*, (2007).

The recent researches also clearly support positive relationship between GSCM practices and organisational performance like (i.e., Zhu *et al.*, 2005, 2008a, 2008b; Zhu & Sarkis, 2007). The results of the current research support that there is a positive relationship between IEM,

CONCLUSION AND RECOMMENDATIONS

GSCM researches have focused on developed countries with less attention to developing economies. Further, there is more focus on manufacturing sector compared to other sectors. This study highlights the importance of the construction sector and the role of GSCM practices in enhancing the effectiveness of organisations, at the same time saving the environment, minimising waste and pollution. The findings of the study show mixed results that are consistent with previous studies in different sectors.

GSCM is still a relatively new concept in the construction sector in Jordan. Construction companies have to be aware of the importance of the GSCM for their organisdle tion and environment. Internal environmental management, especially commitment from top-level managers and support from mid-level managers, will be necessary for the development of any GSCM programs in the construction sector in Jordan. Thus, raising awareness of management in GSCM practices is one of the initial crucial steps in this arena. Small-sized organisations pay less attention to environmental management systems when compared to both medium- and large-sized organisations. Reasons may include the lack of resources and/or industrial and consumer marketing pressures (Zhu *et al.*, 2008b). For small organisations to better market themselves to potential business partners, more policies should be designed and implemented by government and professional groups to encourage small organisations to improve their

environmental performance. The ministry responsible for the environment in Jordan and Jordanian construction contractor association, should work together to enhance environmental awareness within construction projects in Jordan. Environmental management should and to put it into practice as the country signed Paris climate change agreement, and educated the members of the association about environmental management system due to the lack experience as well as lack of the necessary tools and management support to adapt it.

With the globalisation, companies who are trying to establish long-term relationships with foreign customers tend to have higher environmental awareness, which may result in stronger drivers and pressures for GSCM practice. By acquiring more international experiences from leading companies in developed countries (Zhu & Sarkis, 2006), the construction sector could improve its environmental performance and then establish a long-term relationship, which could improve organisational performance. In addition, creating a sustainable economy in developing countries represents a continuous challenge in achieving economic party with the developed world (Zhu & Sarkis, 2006). Hence, the ministry of industry in Jordan and construction sector should work together to benefit from world trade organisation (WTO) initiatives. The foreign customer needs to work with an exchange party without extensive pollution of the environment, responsible for achieving international standard for sustainability. The foreign customer establishes requirements for their exchange party such as developing environmental system, or obtain ISO 14001 certification. This is how to be a long-term supplier in a joint venture or foreign direct investment.

The current research used a quantitative methodology. However future research could use mixed methodological approach to enhance the understanding of numerical results. Literature suggests that size may be a limiting factor to green activities and may also be considered a moderating factor within less active smaller organisations less active (Holt & Ghobadian, 2009; Zhu *et al*., 2008b). The current research does not take into account the size of the organisation on GSCM practices. Further work should be conducted to understand the role that small and medium organisations play in this field. Also, this research and most of the literature were conducted in the private sector, future research could consider the public sector and also explore the differences that exist between both public and private sectors (Walker *et al*., 2008). As was previously mentioned, the foreign customer is looking for suppliers who meet their environmental policies that are shaped by cultural norms in the host country. Therefore, considering national norms as a moderating variable between GSCM practices and performance could be the subject of future research endeavours.

Acknowledgement

This study wishes to acknowledge the partial support received from the Deanship of Scientific Research at Mutah University, Jordan.

REFERENCES

Al Khattab, S.A. & As'ad, H. (2015). The impact of the green supply chain management on environmental-based marketing performance. *Journal of Service Science and Management, 8*(04), 588. https://doi.org/10.4236/jssm.2015.84059

Al-Ma'aitah, N. (2014). An Examination of Supply Chain Relationships in Jordanian Manufacturing Context: A Cultural Perspective. PhD Thesis, University of Kent, UK, Canterbury.

Al-Ma'aitah, N. (2018). The Role of Justice in Achieving Long-term Buyer-Supplier Relationship: The Case of Jordanian Manufacturing Sector. *International Review of Management and Marketing*, *8*(2), 109-117.

Amemba, C.S., Nyaboke, P.G., Osoro, A. & Mburu, N. (2013). Elements of green supply chain management. European Journal of Business and Management, 5(12), pp.51-61.

Balasubramanian, S. & Shukla, V. (2017). Green supply chain management: an empirical investigation on the construction sector. *Supply Chain Management: An International Journal*, *22*(1), 58-81. https://doi.org/10.1108/SCM-07-2016-0227

Balasubramanian, S. & Shukla, V. (2017b). Green supply chain management: the case of the construction sector in the United Arab Emirates (UAE). *Production Planning & Control*, *28*(14), 1116-1138. https://doi.org/10.1080/09537287.2017.1341651

Chowdhury, M., Upadhyay, A., Briggs, A. & Belal, M. (2016). An empirical analysis of green supply chain management practices in Bangladesh construction industry. Available online: http://eprints.brighton.ac.uk/16113/

Darnall, N., Jolley, G.J. & Handfield, R. (2008). Environmental management systems and green supply chain management: complements for sustainability? *Business Strategy and the Environment*, *17*(1), 30-45. https://doi.org/10.1002/bse.557

Diab, S.M., AL-Bourini, F.A. & Abu-Rumman, A.H. (2015). The impact of green supply chain management practices on organisational performance: A study of Jordanian food industries. *Journal of Management and Sustainability*, *5*(1), 149. https://doi.org/10.5539/jms.v5n1p149

Diabat, A. & Govindan, K. (2011). An analysis of the drivers affecting the implementation of green supply chain management. *Resources, Conservation and Recycling*, *55*(6), 659-667. https://doi.org/10.1016/j.resconrec.2010.12.002

Dubey, R., Bag, S. & Ali, S.S., (2014). Green supply chain practices and its impact on organisational performance: an insight from Indian rubber industry. *International Journal of Logistics Systems and Management*, *19*(1), 20-42. https://doi.org/10.1504/IJLSM.2014.064029

Green Jr, K.W., Zelbst, P.J., Meacham, J. & Bhadauria, V.S. (2012). Green supply chain management practices: Impact on performance. *Supply Chain Management: An International Journal*, *17*(3), 290-305. https://doi.org/10.1108/13598541211227126

Hervani, A.A., Helms, M.M. & Sarkis, J. (2005). Performance measurement for green supply chain management. *Benchmarking: An international Journal*, *12*(4), 330-353. https://doi.org/10.1108/14635770510609015

Holt, D. & Ghobadian, A. (2009). An empirical study of green supply chain management practices amongst UK manufacturers. *Journal of Manufacturing Technology Management*, *20*(7), 933-956. https://doi.org/10.1108/17410380910984212

KalianiSundram, V.P., Rajagopal, P., Bahrin, A.S. & Subramaniam, G. (2018). The role of supply chain integration on green practices and performance in a supply chain context. A conceptual approach to future research. *International Journal of Supply Chain Management*, *7*(1), 95-104.

Marhamati, A. & Azizi, I. (2017). The impact of green supply chain management on firm competitiveness. *International Journal of Supply Chain Management*, *6*(4), 215-223.

Mukiri, M. (2007). Green supply chain management practices by manufacturing firms in Kenya. Unpublished MBA project, University of Nairobi.

Nasrollahi, M. (2018). The impact of firm's social media applications on green supply chain management. *International Journal of Supply Chain Management, 7*(1), 16-24.

Ninlawan, C., Ninlawan, P., Tossapol, K. & Pilada, W. (2010). The implementation of green supply chain management practices in electronics industry. In Proceedings of the International Multiconference of Engineers and Computer Scientists (Vol. 3, pp. 17-19). March.

Petljak, K., Zulauf, K., Štulec, I., Seuring, S. & Wagner, R. (2018). Green supply chain management in food retailing: Survey-based evidence in Croatia. *Supply Chain Management: An International Journal*. https://doi.org/10.1108/SCM-04-2017-0133

Sarkis, J. (2003). A strategic decision framework for green supply chain management. *Journal of cleaner production, 11*(4), 397-409. https://doi.org/10.1016/S0959-6526(02)00062-8

Sarkis, J., Zhu, Q. & Lai, K.H. (2011). An organisational theoretic review of green supply chain management literature. *International Journal of Production Economics, 130*(1), 1-15. https://doi.org/10.1016/j.ijpe.2010.11.010

Shah, M.G.H. & Muraduzaman, M. (2013). An overview of green supply chain management in Bangladesh. *International Journal of Advancements in Research & Technology, 2*(5).

Srivastava, S.K. (2007). Green supply-chain management: A state-of-the-art literature review. *International Journal of Management Reviews, 9*(1), 53-80. https://doi.org/10.1111/j.1468-2370.2007.00202.x

Testa, F. & Iraldo, F. (2010). Shadows and lights of GSCM (Green Supply Chain Management): Determinants and effects of these practices based on a multi-national study. *Journal of Cleaner Production, 18*(10-11), 953-962. https://doi.org/10.1016/j.jclepro.2010.03.005

Vachon, S. & Klassen, R.D. (2006). Extending green practices across the supply chain: the impact of upstream and downstream integration. *International Journal of Operations & Production Management, 26*(7), 795-821. https://doi.org/10.1108/01443570610672248

Walker, H., Di Sisto, L. & McBain, D. (2008). Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors. *Journal of purchasing and supply management, 14*(1), 69-85. https://doi.org/10.1016/j.pursup.2008.01.007

Zhu, Q. & Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *Journal of Operations Management, 22*(3), 265-289. https://doi.org/10.1016/j.jom.2004.01.005

Zhu, Q. & Sarkis, J. (2006). An inter-sectoral comparison of green supply chain management in China: Drivers and practices. *Journal of Cleaner Production, 14*(5), 472-486. https://doi.org/10.1016/j.jclepro.2005.01.003

Zhu, Q. & Sarkis, J. (2007). The moderating effects of institutional pressures on emergent green supply chain practices and performance. *International Journal of Production research, 45*(18-19), 4333-4355. https://doi.org/10.1080/00207540701440345

Zhu, Q., Sarkis, J. & Geng, Y. (2005). Green supply chain management in China: pressures, practices and performance. *International Journal of Operations & Production Management, 25*(5), 449-468. https://doi.org/10.1108/01443570510593148

Zhu, Q., Sarkis, J. & Lai, K.H. (2008). Confirmation of a measurement model for green supply chain management practices implementation. *International Journal of Production Economics, 111*(2), 261-273. https://doi.org/10.1016/j.ijpe.2006.11.029

Zhu, Q., Sarkis, J. & Lai, K.H. (2012). Examining the effects of green supply chain management practices and their mediations on performance improvements. *International journal of production research, 50(*5), 1377-1394. https://doi.org/10.1080/00207543.2011.571937

Zhu, Q., Sarkis, J. & Lai, K.H. (2013). Institutional-based antecedents and performance outcomes of internal and external green supply chain management practices. *Journal of Purchasing and Supply Management, 19(*2), 106-117. https://doi.org/10.1016/j.pursup.2012.12.001

Zhu, Q., Sarkis, J., Lai, K.H. & Geng, Y. (2008b). The role of organisational size in the adoption of green supply chain management practices in China. *Corporate Social Responsibility and Environmental Management, 15*(6), 322-337. https://doi.org/10.1002/csr.173

Zhu, Q.H. & Geng, Y. (2002). Study on the effect of enterprises' green purchasing. *China Soft Science, 11*, 71-74.

APPENDIX

Variable	Item
Internal environmental management (IEM)	Commitment of GSCM from senior managers (IEM1)
	Support for GSCM from mid-level managers (IEM2)
	Cross-functional cooperation for environmental improvements (IEM3)
	Total quality environmental management (IEM4)
	Environmental compliance and auditing programs (IEM5)
	ISO 14001 certification (IEM6)
	Environmental Management Systems exist (IEM7)
Green purchasing	Eco-labeling of Products (GP1)
	Cooperation with suppliers for environmental objectives (GP2)
	Environmental audit for suppliers' internal management (GP3)
	Suppliers' ISO14000 certification (GP4)
	Second-tier supplier environmentally friendly practice evaluation (GP5)
Green Transportation	Provision of accommodation to employees near project sites (GRTRAN1)
	Use of video conferencing (GRTRAN2)
	Employees are encouraged to use shared transport and public transport (GRTRAN3)
	Materials are transported in full truckload quantities (GRTRAN4)
	Materials are transported in fuel efficient vehicles (GRTRAN5)
Eco-design	Design of products for reduced consumption of material/energy (ECO1)
	Design of products for reuse, recycle, recovery of material, component parts (ECO2)
	Design of products to avoid or reduce use of hazardous products and/or their manufacturing process (ECO3)
Green Construction	Provision for waste water recycling at project/manufacturing site (GRNCON1)
	Use of prefabricated components in projects (GRNCON2)
	Use of materials with high recycled content and low embodied energy (GRNCON3)
	Reducing use of hazardous materials (GRNCON4)
	Comprehensive waste management plan for project/manufacturing sites (GRNCON5)
	Automation is used for onsite construction/manufacturing activities (GRNCON6)
	Fuel efficient equipment/machinery are used at project/manufacturing site (GRNCON7)
Investment recovery	Investment recovery (sale) of excess inventories/materials (IR1)
	Sale of scrap and used materials (IR2)
	Sale of excess capital equipment (IR3)
Variable	**Item**
Environmental Performance	Number of environmental accidents has declined (ENVPER1)
	Greenhouse gas emissions have decreased (ENVPER2)
	Water consumption has decreased (ENVPER3)
	Energy consumption has decreased (ENVPER4)
	Landfill waste has decreased (ENVPER5)
	Material use has decreased (ENVPER6)
	Hazardous material use has decreased (ENVPER7)
Economic Performance	Material expenses per unit constructed/manufactured has decreased (ECONPR1)
	Water expenses per unit constructed/manufactured has decreased (ECONPR2)
	Energy expenses per unit constructed/manufactured has decreased (ECONPR3)
	Cost of managing waste per unit constructed/manufactured has decreased (ECONPR4)
	Total environmental penalties and fines per unit constructed/manufactured has decreased (ECONPR5)
Organisational Performance	Increase in sales (ORGPER1)
	Increase in sales price (ORGPER2)
	Increase in market share (ORGPER3)
	Increase in return on investment (ORGPER4)
	Increase in profits (ORGPER5)